ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXI, No. 25. CHICAGO, SATURDAY, DECEMBER 21, 1912. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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HIGH-TENSION TESTS OF INSULATORS.

With the rapid multiplication of high-tension transmission lines the subject of testing insulators for this purpose has become one of considerable importance and was very appropriately placed upon the program of the meeting of the American Institute of Electrical Engineers held last week in New York City. The papers presented and the discussion upon them should help in the formulation of standard specifications for testing insulators for this purpose. Standardization of the methods of testing is greatly to be desired as an aid both to the manufacturer in furnishing suitable material and to the purchaser in obtaining the proper article for his purpose and one of dependable and uniform quality.

The paper by Messrs. Imlay and Thomas, as well as experience in actual operation, has demonstrated that the customary tests of insulators at low frequency in the factory is no criterion of their performance in operation when submitted to the surges occasioned by lightning, grounds, switching operations, etc., in the circuit. Insulators which merely flash over when the voltage is raised under test are found to puncture when a high voltage is applied under different conditions on the line. Whether the observed effects are due primarily to the high frequency or to the suddenness of application of the voltage was left in doubt by the discussion at this meeting.

When an oscillatory discharge takes place, the frequency of oscillation is determined by the capacity, inductance and resistance of the circuit. When the resistance is large the oscillation is rapidly damped and Mr. Lincoln very properly raised the question in the discussion as to whether the maximum voltage in the experiments described was applied to the insulator more than once for each such discharge. It is unfortunate, too, that the actual frequency of oscillation was not measured, instead of being merely estimated from the dimensions of the circuit, since it is not a difficult matter to make such measurements. Further experimenting along this line with high frequencies, supplemented by experiments at intermediate frequencies such as 100,000 to 200,000 cycles, as described by Professor Creighton in his discussion, should help to solve the problem as to just what is at the root of the observed difference in behavior of the insulators.

The tests carried out by Mr. Sothman have served to point out some of the deficiencies in the suspen-

sion insulators which have heretofore been available, and his work should help to an advance in the design of this article. Little change has been made in these insulators during the past few years, partly due no doubt to insufficient publicity of the experience which has already been accumulated by those working in this line.

The whole subject is one upon which much work yet remains to be done before either the form of insulators or the method of applying routine tests to them can be standardized, which is an ultimate result to be hoped for. With our ever increasing knowledge of the phenomena of disruptive discharge and high-frequency effects, we may hope in the near future to have sufficient knowledge of the subject to predict the behavior of an operating line under any given conditions.

SUBSTITUTIONS FOR STANDARD CONSTRUCTION.

As a rule the inventive faculty is something to be greatly desired, and those whom nature has favored with this rather rare gift should be encouraged to make the most of it. It is extremely unfortunate, however, that men who attempt to invent things or to discover new ways of doing some piece of work or other do not always first make sure that the object they seek to accomplish has not already been accomplished in an entirely satisfactory manner. Failure to take this precaution has many a time resulted in keen disappointment and a deplorable waste of time and money. One sees much of this sort of thing in the electrical field and, judging from the frequent crude substitutes for standard practice in wiring which one finds, it appears that electric wiremen are especially guilty of the omission referred to.

No well informed electrician would for a moment contend that improvements cannot be made in the methods of electrical construction now considered standard, nor that the line of approved wiring supplies and fittings on the market is perfect and complete. It is not meant to convey any such impression here. It is intended, though, to emphasize the necessity of the most complete familiarity with standard electrical fittings and construction methods, on the part of men engaged in electrical construction, and to insist that nine times out of ten efforts to make substitutions for these, whether such efforts be due to ignorance or be inspired by a desire to try new ways of doing things, result in a relatively low grade of construction. To cite an example or two, some combinations of plugs and screws for holding a circuit on a wall or ceiling may be delightfully ingenious, but manufacturers are selling expansion bolts that fulfill the desired purpose far better; a lamp socket and a plug may do for a pendent switch, but this is a very poor substitute for the regular fitting; and this kind of construction should have been abandoned finally when electric lighting passed the experimental stage and people no longer installed electric service with a feeling that they would probably soon find it unsatisfactory and hence have it discontinued.

By the free use of all available literature on the subject as a supplement to his practical every-day experience, every electric wireman ought to endeavor to keep himself well informed as to the developments in standard fittings and the correct use of these. Moreover, he can well afford to insist that such fittings be used instead of makeshifts, however ingenious the latter may seem to be. It is one of the best ways of avoiding trouble with the inspector, of doing really high-class work, and of improving his reputation as an electrician.

IMPROVING COMPANY PRACTICE BEFORE COMMISSIONS.

Attendance at a large number of hearings before state commissions regulating the issue of securities and the rates in force by public utilities justifies renewed emphasis on our part of the importance of preparing a thorough case in work of this kind. Here is manifestly a chance for not a few companies to turn over a new leaf as another year approaches and to resolve to handle such duties in a more business-like manner than has sometimes been witnessed. To take the single instance of an appearance before a state commission in support of a petition for additional stock or bonds to meet notes issued to carry through important construction work, the point should be driven home that such a company cannot expect to obtain the desired results efficiently unless it is prepared to answer every reasonable inquiry bearing upon its expenditures and practice.

No conscientious commission responsible to the people of its state for the issue of securities, and consequent establishment of added yearly fixed charges to be met by the public, can possibly make a fair determination of the issue of new stock or bonds and justify its standing and action unless it is placed in a position to practically audit the expenditures which it is desired to capitalize. If a new power house has been built and the money for it is to be raised by a new stock issue, the company should appear at the hearing of the regulating board with full information as to the cost of each important piece of machinery, the investment required for the building, with the size and structural character of the latter, and the essentials of all contracts, summaries of vouchers, etc., which show almost at a glance to an experienced appraiser that the outlay made is perfectly proper under the circumstances. Too often statements are presented to such state commissions lacking the subdivision necessary for their intelligent analysis. The cost of preparing a complete case in connection with such security issues, is well worth the moderate expense involved, for it saves the time of high-priced men before the regulating tribunal and also furnishes the company itself with data of permanent value.

MOVING PICTURES AND ELECTRICAL PROGRESS.

The influence of the moving picture upon the public mind is not easily overestimated in these days, and in the educational possibilities of the low-cost playhouse lie opportunities for the molding of popular opinion which are as yet only partially appreciated. Reference was made some time ago in these columns to the usefulness of electrical plays from the instructive standpoint, and the contention made that where such entertainments illustrate the methods of performing real work in the field, as in the splicing of cables in manholes, much valuable publicity on behalf of electrical service is obtained, and above all, at a time when the popular mind is unusually susceptible to impressions. Similar considerations apply to the treatment of electrical subjects in motion pictures.

In a recent visit to a picture house making a specialty of clean and instructive displays, the harnessing of a mountain stream was shown in a realistic fashion, with moving views of flume inspection, supply of water to pipe lines and penstocks, the operation of a water-wheel governor in the power house, the running of a direct-connected alternator and finally, the discharge of the tail water from the draft tubes. The pictures gave the most uninformed observer a clear idea of the character of country through which hydroelectric developments are often carried, and while the selection of pictures might have been improved by other views showing the transmission and utilization of electrical energy from the harnessed stream, there is no question that the semi-serious entertainment afforded was a step in the direction of arousing popular interest in a subject with which a great many persons are utterly unacquainted. Certainly the display of such views, improved as it might be by scenes illustrating all the important stages of a hydroelectric development down to the reading of switchboard instruments and the operation of shops by motors, would tend to interest the public in the best form of water-power conservation by its use and might be a positive factor in stimulating the popular demand that such resources be more generally turned to account.

Not only the general public but technically trained men are finding the moving picture a useful institution in connection with society and club meetings, lectures on behalf of central-station service, and campaigns designed to arouse the interest of special classes in such matters as the use of the electric truck and the manipulation of electric heating apparatus. At a recent electric-railway-club meeting a special process of welding motor cases, shafts and other equipment was shown to a large assemblage in most effectual style, and it is obvious that the manufacturer of such instructive views has in the world of industry practically an unlimited selection of profitable subjects.

IMPROVING STREET-LIGHTING SERVICE.

The consolidation of public utilities in a number of adjoining municipalities under a single management leads in many cases to a revamping of the existing street-lighting installations and the consequent betterment of the service throughout a wide area. It is natural that this should be so, because the practice of neighboring communities is rarely very closely standardized under independent management of the electric systems, and a careful study of the equipment and contracts shows in many instances striking differences in methods and agreements. When a new management goes into a locality, therefore, one of the most pressing problems that it is likely to encounter is the important question of establishing a uniform quality of service among the different communities reached by the lines, regardless of the details of price and hours of lamp-burning in vogue.

In a representative case where a company entered a manufacturing town, the street-lighting service was originally supplied by two old-type arc machines, without any auxiliary generating unit, so that in case of a breakdown in any town on the system, half the lights in the central community went out. All the towns served were tied together on the same machines and there was no flexibility in the operation of the system. The first move made by the new management was to do away with these two machines, and at considerable expense to the company, tungsten clusters were offered to the town and accepted, with a greatly improved distribution of lamps. The circuits supplying the surrounding towns were then separated from one another, so that trouble arising in any town would be localized. Along with these betterments of the street-lighting system, additional generating capacity in more modern units was installed at the company's power plant and the entire overhead system was gone over and poles and circuits in bad condition were replaced by modern equipment carefully installed. The company wisely took the public into its confidence during the transition period, and the local press published a complete story of the causes of the former poor service, the efforts the company was making to do away with conditions justly giving rise to complaints, and the causes and remedies bearing upon irregular supply to consumers and interruptions in the street-lighting service during the change-over. The results justified the pains taken, and the community was put in possession of the exact facts from time to time in language as free from technicalities as possible, showing the precise steps being taken to modernize the system and finally pointing to a date after which normal service of the first quality could be reasonably anticipated.

It is doubtful if a better way could have been found of disarming a local hostility inherited from conditions beyond the control of the new interests in charge of the property.

Tables for 1913 Street Lighting.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN has published for the year 1913 its customary tables for street lighting, which show in tabular form the proper time for lighting and extinguishing street lamps on the all-night and the moonlight schedules. The total number of hours of lighting for each month and the year is given for these two schedules and also for a simplified form of Frund's schedule and for the moonlight-midnight schedule. Simple rules are given by which the times of lighting and extinguishing are obtained for the latter schedules from the tables published.

The tables are printed on a sheet of convenient size which forms an insert in a small booklet containing instructions and related information. This sheet may be removed for posting on a wall for easy reference.

One copy of the lighting tables will be sent free of charge to any subscriber requesting one. The price to others and for additional copies will be ten cents, as heretofore.

Government Use of Patented Articles.

In the report of the solicitor for the Navy Department to the Secretary of the Navy, attention is called to the act of June 25, 1910, authorizing owners of patents used by the Government to bring suit in the Court of Claims for compensation. In view of a case recently decided by the Supreme Court this will have a greater effect upon the matter of compensating patentees than was at first supposed, and it is stated by Navy officials that the Department now feels at liberty to exercise the right of eminent domain over all patents whenever necessary.

In the case cited the court held that inasmuch as the inventor or the owner of a patent has, under said statute, a remedy for any wrong to him by the Government, such inventor or owner of the patent could not obtain an injunction against the manufacture by a contractor of a patented article intended for the Government's use. Such decision places the act mentioned in the category of legislation exercising the right of eminent domain, and frees the hand of the Department to appropriate and use without delay the property rights of the citizen without depriving him of just compensation. This privilege is of great value to the Department in ordinary times and especially in time of war.

National Electric Light Association Plans for the Chicago Convention.

A meeting of the executive committee of the National Electric Light Association was held in Chicago last week in conjunction with the meetings of the membership committee, publications committee, finance committee, committee on electricity on the farm, committee on wiring of existing buildings, committee on ice and refrigeration, committee on electrical merchandizing, committee on advertising, committee on education of salesmen, and the exhibition committee. All these committees reported progress and the indications are that a very elaborate series of reports will be presented at the convention, which will be held at the Medinah Temple, Chicago, June 2 to June 5, inclusive.

At the meeting of the exhibition committee Homer E. Niesz of the Cosmopolitan Electric Company, Chicago, was elected a member, and H C. McConnaughy of the Dearborn Drug & Chemical Works, New York, was elected secretary of the committee to succeed Walter Neumuller, resigned. Both Mr. Niesz and Mr. McConnaughy have had a great experience in the handling of exposition details, and to them was delegated the responsibility for making arrangements for the holding of the exhibition in connection with the 1913 convention. A formal reception will be held on Monday evening opening the exhibition, which will be continued until Friday evening. The committee visited Medinah Temple and made a careful inspection of the facilities which apparently are excellent in every detail.

Tariff Hearings.

The Committe on Ways and Means of the House of Representatives has decided to hold hearings respecting the contemplated revision of the tariff during the month of January, in Washington, D. C.

Schedule B, including earths, earthenware and glassware, will be considered on Wednesday, January 8; and Schedule C, covering metals and manufactures, on Friday, January 10. Sessions will be held at 10 a.m. and 2 p.m.

Persons desiring to be heard should apply to the clerk of the Committee previous to date set for the hearing to be assigned time on the program for that day. In making application, the name, address, temporary address at Washington, firm or corporation represented, paragraphs of the schedule concerning which testimony will be given, attitude toward revision and amount of time desired should be stated.

Denver's Indian Pageant.

John A. Hunter, professor of mechanical engineering of the University of Colorado, spoke on "Engineering Efficiency" at the regular weekly luncheon of the Colorado Electric Club at the Albany Hotel, Denver, on December 12. Professor Hunter is a member of the club and his address was very interesting.

The Electric Club has about completed plans for the annual Christmas dance which will be one of the most novel and elaborate ever given by the organization. A number of prizes donated by different electrical manufacturers and dealers of the city will be given to the ladies attending.

A resolution was also adopted by the club in which it was decided to lend all the help possible in advertising Denver's 1915 Indian Pageant. A number of the local business men interested in the festival were present at the luncheon and outlined the plans for the show. It is planned to bring 15,000 Indians from all of the western reservations, the old-time cowboys and scouts, including "Buffalo Bill" Cody, to Denver, to reproduce the scenes of early days. Among the features under consideration by the Booster Committee which has been formed by local business men, is one to reproduce the Custer Massacre.

The Denver Gas and Electric Light Company, realizing the value of such an exposition, recently donated $10,000 to the committee. This was the first sum of money given by any of the business establishments in Denver and it put the movement on a strong footing, giving assurance that the pageant will be reproduced as originally planned. The idea of the festival is to attract thousands of tourists who will pass through Colorado en route to the World's Fair at San Francisco in 1915. The Electric Club also passed a resolution at its meeting of December 12 to give all the publicity possible to the new slogan adopted by the Denver men interested in the 1915 exposition. It is: "Denver the Front Door of the Great West."

Telephone Transmission.

A meeting of the transmission experts of the Bell telephone system was held in Pittsburgh December 9 and many projects for further improvements in the service were discussed. All the supervisors, plant chiefs and wire chiefs, with their engineers and immediate assistants within a territory of 400 square miles surrounding Pittsburgh were in attendance. Superintendent S. P. Grace presided.

Higher officials of the Bell telephone system were in Pittsburgh recently and said that a large sum of money would be spent on improvements.

Sigmund Bergmann.

Upon the occasion of the celebration of the sixtieth birthday of Sigmund Bergmann on June 5, 1911, his lifelong friend, Francis Jehl, memorialized Mr. Bergmann in a very graceful literary tribute. The foreword was "Sigmund Bergmann—from Wooster Street, New York, to the Oudenarder Strasse in Berlin." To those who are familiar with the extremes indicated in this suggestion there comes to mind a picture of laborious beginnings, high hopes, great struggles, and a desirable consummation of results satisfactorily achieved.

Mr. Jehl says that the many years of earnest and productive labor that Mr. Bergmann rendered during his long sojourn in the United States and his help while here in starting and building up a new art, places his name in the foremost ranks in the history and development of electric lighting in this country.

Sigmund Bergmann was born in Mulhausen, Turingia, Germany, June 5, 1851, hailing direct from a patriarchal family; his grandfather, Adolph Bergmann, being a well known and respected citizen at that time. The distresses incident to the Napoleonic wars in the beginning of the eighteenth century wrought havoc and heavy losses with the fortunes of the Bergmann family. Nevertheless, Sigmund received a good and sound practical education and he might have continued his studies had he not shown such a determined inclination during his youth for the pursuit of studies in mechanics and the construction of mechanical toys and machines.

When he reached his fourteenth year he was apprenticed to one of the best mechanicians of his native city, and his deftness and ability rapidly won the esteem and admiration of his master. Bergmann was ambitious and his desire to advance faster than the limits of his native town allowed forced him within a few years to leave the place of his birth. He spent a few years more in some of the best shops in Germany and left Europe in 1870 to make his way in the new world.

He was associated with Edison for several years and being imbued with the idea that he should turn his talents in a direction that would insure to him the greatest possible personal reward he established a business of his own and began to manufacture private line telegraph printers for the Gold & Stock Telegraph Company, together with burglar alarms, bells, batteries, telephones and other electrical apparatus. His ingenuity as an inventor and his great popularity soon made his establishment headquarters for the development and manufacturing of new electrical apparatus, and he was intimately and actively connected with some of the most important of the earlier electrical machines. Mr. Jehl says that many of Edison's experiments were made in the Bergmann shop, while the phonograph was to a great extent developed with Bergmann's assistance. In connection with the development of the incandescent lamp, Bergmann assisted very materially in its practical construction and in the design and manufacture of machines and accessories. All this experience and ability led to a business partnership with Mr. Edison, which was continued successfully and harmoniously for a period of some 12 years, when in the later development the Edison interests were combined and reorganized, Bergmann disposing of his interests very profitably.

Sigmund Bergmann,
Prominent European Manufacturer.

In 1892 Bergmann organized the New York Electric Equipment Company, becoming president and principal owner, and took over the electrical equipment of the Edison Electric Illuminating Company of New York. During this time he also founded a European works at Berlin, Germany, beginning there the manufacture of all kinds of electrical accessories. He also organized the General Incandescent Arc Light Company of New York, and was for some years its principal owner and president.

This apparently was the ripening of Bergmann's experience here, and he soon went to Europe to superintend and devote his entire attention to the development of his works in Berlin, incorporating there the ideas he had developed in America, utilizing American tools and machinery, and establishing as chiefs of his staff several Americans who had gone back to the old country with him. The works grew rapidly in size, and today the Bergmann Elektricitats Werke is a fine specimen of modern manufactory, employing something like 10,000 men, manufacturing complete lines of electrical and allied mechanical apparatus.

Outside of the great workshops, Bergmann has built up a large brass and copper works, and in Austria he has also developed an electrical works where there are also manufactured a line of steam turbines and a line of electric and gasoline automobiles.

While the expansion of all his undertakings has indicated that the man is possessed of a remarkable genius in finance and organization, and all of his affairs have suggested the greatest commercial and business sagacity he has preserved and enlarged his capacity for humanizing his interest in his fellow men. While he has not been conspicuous so far as public recognition of his charities is concerned, it is understood that he has upon occasion after occasion contributed most liberally to the maintenance of philanthropies for the betterment of those less fortunately situated than he.

Lynn Ornamental Lighting.

The city of Lynn, Mass., has installed 151 lamps of 1,000 candlepower each along the main business streets. The lamps are set on poles 14 feet high at intervals of 60 and 80 feet. The cost of the installation, $11,000, was defrayed by contributions of citizens collected by a joint committee of the Lynn Board of Trade and the Lynn Retail Merchants' Association. The city will pay the cost of energy for lighting.

Chicago Jovians to Have Banquet.

Arrangements are being made to hold a Jovian banquet at the Hotel Sherman, Chicago, Ill., on the evening of Friday, January 10, 1913. The committee in charge of plans for this banquet is working under the direction of George C. Richards, statesman for Illinois. He is being assisted by M. S. Hart, A. R. Dean, Arthur J. Selzer, C. E. Waddington, Sam A. Hobson, and A. A. Gray.

Invitations are being extended to a number of men prominent in electrical circles in Chicago, several of whom are already members of the Jovian order. It is expected that Jupiter, Frank E. Watts, will be in attendance and that address will be made by several other men identified with the industry. At this banquet plans will be outlined for a rejuvenation which will be held during March as a preliminary for a monster rejuvenation and banquet which will be held in connection with the convention of the National Electric Light Association which will be held at Medinah Temple, Chicago, June 2 to 5.

Louisiana Sons of Jove to Hold Rejuvenation.

F. B. Stern, statesman for Louisiana, announces that the Louisiana Sons of Jove will have an elaborate electrical street parade and a rejuvenation at New Orleans on the evening of February 1, 1913. It is expected that there will be a big attendance in New Orleans in the midst of the carnival festivities. The first carnival parade will be on the evening of Thursday, January 30, and the last parade on Tuesday, February 4. There will be a crowd of out-of-town visitors in the city at that time. Mr. Stern wants to make this affair a big success for Jovianism, and requests that all Jovians who can be in attendance should correspond with him so that proper arrangements may be made for reservations in advance.

Mississippi Convention.

The fifth annual convention of Mississippi Electric Association will be held April 21, 22 and 23, at Natchez, Miss. Arrangements have been perfected for the Association to meet at Vicksburg on the morning of April 21, when passage will be taken on Steamer *Concordia*, leaving Vicksburg at noon.

Natchez will be reached early next morning. During the trip on the Mississippi River the first day's session of the convention will be held. Entertainment of an enjoyable character has been provided for that night.

The steamer trip on the "Father of Waters" will be an interesting and unique experience to everyone, and should prove a drawing card that will make the fifth convention the largest and most successful in the Association's history.

Details of sessions and entertainment at Natchez will be announced later.

St. Louis Section Meeting.

The Union Electric Light & Power Company Section of the National Electric Light Association held a meeting at the City Club, St. Louis, Mo., on the evening of November 29, with President Hull in the chair. An illustrated talk on power developments at Niagara Falls was delivered by A. S. Langsdorf, professor of electrical engineering in Washington University. Music for the occasion was furnished by the Union Electric Orchestra. Some moving pictures were also thrown on the screen.

The present quarters of the Union Electric organization have been found inadequate on account of the proportions which the social and welfare features of the organization have assumed. The Company has leased space in the adjoining building for use as a lunch room, library and assembly room. In addition to the orchestra, glee club and athletic teams, the Company is outlining a welfare association, the feature of which will be a mutual benefit loan fund.

Beginning January 1, 1913, a monthly publication will be issued to be known as the *Union Electric Bulletin*. This will be the organ of the local section. Through its influence it is hoped to bring non-member employees into the fold and weld them together in a bond of social and business fellowship and work, for the common good of the company and themselves.

Electric-Vehicle Banquet.

The Board of Directors of the Electric Vehicle Association of America are arranging a testimonial banquet to be tendered W. H. Blood, Jr., at Delmonico's, New York City, on January 16, 1913, in recognition of his work as president of the Association. During his two years of service he has been a most earnest and efficient officer and under his active guidance since the birth of the organization, there has been accomplished much constructive work which has placed it upon a satisfactory foundation. The directors believe that the members will be glad to express their appreciation of Mr. Blood's efforts and earnestly urge every member to attend the banquet.

The committee in charge consists of Charles Blizard, chairman; Frank W. Smith, Arthur Williams and P. D. Wagoner. Subscriptions ($10) should be sent to the last named, Borden and Review Avenues, Long Island City, N. Y.

Utilities Inquiry of National Civic Federation.

The National Civic Federation has been conducting an inquiry, through its Department on Regulation of Interstate and Municipal Utilities, as to what constitutes adequate regulation of public utilities. The answers of the department to this question are expected to be embodied in a model bill for consideration by states which are about to adopt a program of regulation. Legislation of this character is being actively considered in many states, such as Pennsylvania, Indiana, Illinois, Kentucky, Minnesota, Missouri, Texas, Colorado, etc. The work includes a compilation of regulatory laws analyzed and annotated, the formulation of a model public utilities bill, a special report on regulation of capitalization and on profit-sharing, and a study of state versus municipal regulation.

Preliminary drafts of the compilation and analysis of present regulation laws have already been printed, this compilation being divided into 16 parts under the following heads: Basis of Rate Making (Rate Reasonableness); Establishment and Change of Rates; Rate Publicity; Discrimination; Service; Accounts; Reports of Utilities; Regulation of Stock and Bond Issues (Capitalization); Intercorporate Relations; Franchises; Safety of Operation; Organization of Commission; Jurisdiction and Definition; General Powers of Commission; Commission Procedure; Enforcement.

The chairman of the department is Emerson McMillin, who has brought to the investigation the experience of a lifetime in the development of public-service enterprises and the solution of problems connected with their relations with the public. The board of directors includes also Franklin Q. Brown, vice-chairman; F. C. Walcott, treasurer; E. A. Quarles, assistant treasurer; John H. Gray, Edward M. Bassett, Martin S. Decker, Halford Erickson, Franklin K. Lane, Blewett Lee, Milo R. Maltbie and Arthur Williams.

The investigation has been conducted under the active direction of John H. Gray, of the University of Minnesota, assisted by William H. Kerr, of Chicago.

Chicago Electric Club.

B. A. Blanchard, associate editor of *Popular Electricity Magazine*, delivered a very interesting lecture before the Electric Club of Chicago on December 12 on "Some Wonders of Electricity the World Over." The lecture was illustrated by lantern slides showing unique and spectacular uses of electricity in scientific and industrial work.

Electricity in Hotel Service—II.

This, the second of a series of three articles dealing with electricity in hotel service, is confined to lighting and gives figures and information on the latest practice in this field. In the third article a summary of all data will be given.

The modern high-class hotel offers in its entirety one of the most attractive problems for the illuminating engineer that can be found in the whole field of lighting. From the purely utilitarian necessitities of the kitchen, store rooms and hall ways to the rooms in which a correctly artistic effect, together with adequate illumination is absolutely essential, there is almost every graduation between the useful and the beautiful.

In addition to this the question of cost of maintenance and operation must be constantly kept in view, as the lighting bills of a large hotel are no small item. The introduction of special scenic and pictorial effects for roof gardens and cafés is another one of the problems offering unusual opportunities for originality of conception and artistic taste. Illumination to conform with the cordial atmosphere of such places must be cheerful, attractive and of a nature to place its patrons in a receptive mood. In view of this, a well designed system of illumination employing the best type of illuminant obtainable is as essential to the success and popularity of a hostelry, as its service or cuisine.

Indirect Lighting of Grecian Marble Room, Blackstone Hotel, Chicago.

With perhaps the exception of exterior lighting, such as over entrances or surmounting the roof, the tungsten-filament incandescent lamp is universally conceded to satisfactorily meet all the requirements of hotel service.

In considering interior lighting of hotels three general systems suggest themselves, namely direct lighting, indirect lighting and semi-indirect. All three systems have their advantages and the installation of either, or any combination, depends in a large measure upon local conditions.

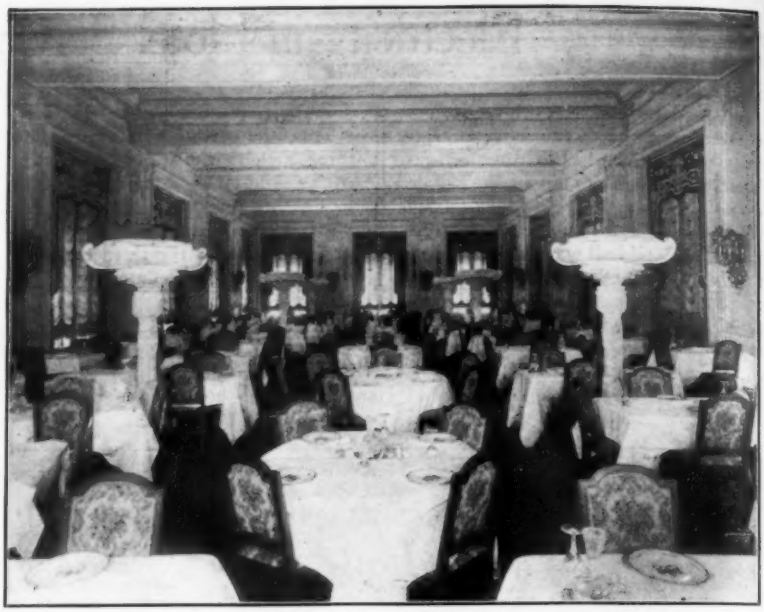
In store rooms, basements, passage ways, kitchens, pantries, etc., of hotels, where the efficiency of the lighting system is the principal consideration, direct lighting is usually preferred. With few exceptions an even distribution of light is more to be desired than high intensity and therefore considerable attention should be given the selection of reflectors. High-wattage tungsten-filament lamps, properly spaced and located sufficiently high to afford ample general illumination should be used wherever possible. Localized lighting is seldom, if ever, required in these departments.

As already stated, however, artistic effect is equally as important as adequate illumination in all parts of the hotel accessible to the public, and, while unfortunately most hotels have given little or no attention to the efficiency of their lighting, it is possible and certainly desirable to install a system or systems of lighting that combine efficiency and pleasing appearance. At this time it may be timely to call attention to the fact that one of the

chief causes of unsatisfactory hotel lighting is the poor regulation maintained. This objection, of course, entirely disappears when power is purchased from the central-station company.

In considering general hotel lighting, for lobby, banquet halls, buffets, barber shops, restaurants, etc., as already stated, three general systems suggest themselves, and while local conditions must govern the selection of either of the three or any combination of them, the following data may prove of value in determining their relative efficiencies.

From the standpoint of efficiency alone, the average taken from a large number of tests show that under favorable conditions an indirect system may be counted on for about two lumens per watt. Small rooms with light walls and ceilings will sometimes show an efficiency as high as 2.5 lumens per watt, while in large rooms with high ceilings, the efficiency may come down to 1.5 lumens per watt and perhaps less.



Indirect Lighting, Louis XIV Room, Congress Hotel.

An extremely interesting test to determine the relative efficiency of an indirect versus a direct system of lighting has recently been completed by the National Electric Lamp Association. The room in which the test was conducted is 19 feet by 39 feet 7 inches with 12 foot 2 inch ceiling. The walls are light yellow and the ceiling flat white. The lighting was provided in one case by eight 150-watt indirect tungsten units uniformly spaced in two rows of four each; while in the other, eight 150-watt tungsten lamps equipped with prismatic reflectors were used in the same outlets. Conditions were made as nearly uniform as possible so that the results would be comparable. Another interesting feature of the test is that both clear and bowl-frosted lamps were used.

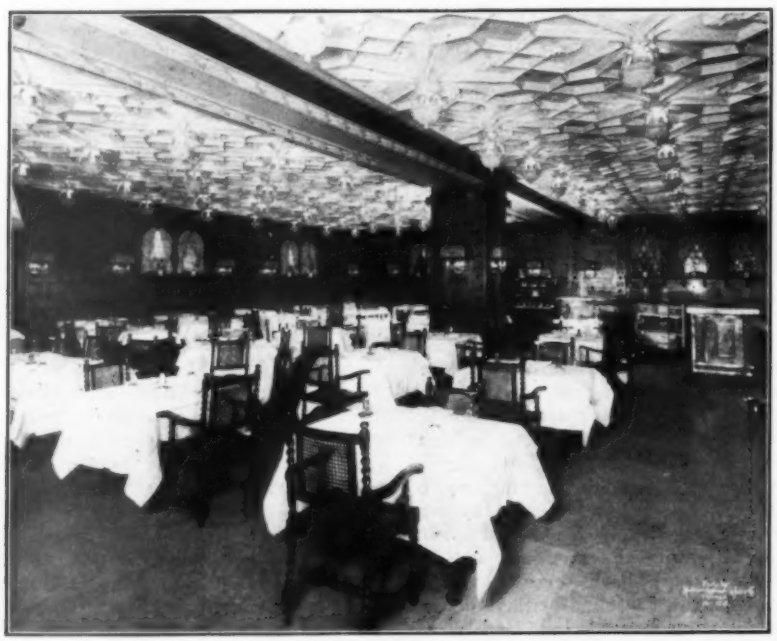
	Direct Illumination		Indirect Illumination	
	Clear	Bowl frosted	Clear	Bowl frosted
Average intensity of illumination..	6.39	5.63	2.77	2.40
Effective lumens per watt	4.00	3.52	1.73	1.51
Relative per cent based on clear lamp, direct system	100.0	88.0	43.3	37.7

Another test conducted on an indirect lighting unit in a small room afforded some interesting information. The dimensions of the room were as follows: length, 9 feet 10 inches; width, 8 feet; ceiling height, 8 feet 3 inches; unit at standard position was 12 inches from ceiling.

	Effective lumens per watt
Black walls, white ceiling.....	1.66
White walls, white ceiling.....	2.43
Maximum variation reduced from 70 to 47 per cent by white ceiling	

Illumination measurements taken with the unit at various distances from ceiling gave the following results. The farther from the ceiling, a little more uniform was the illumination. The best hanging height is plainly evident from these data.

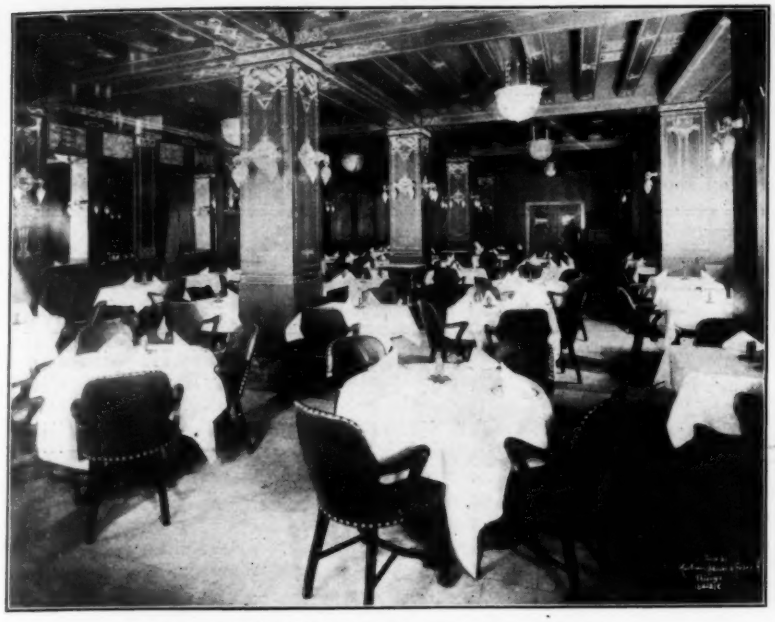
	1 ft.	1 ft. 6 in.	2 ft.	3 ft.
Extreme variation above average, per cent	21.5	19.3	23.7	21.4
Extreme variation below average, per cent	32.0	31.1	20.2	17.6
Effective lumens per watt	2.65	2.90	2.69	2.66



Indirect Lighting, Grill Room, Blackstone Hotel.

A third test was conducted in a barber shop lighted by means of a semi-indirect system. The shop was 36 feet by 18 feet with a 12.6-foot ceiling. The lighting equipment consisted of three 4-lamp fixtures uniformly spaced along the center of the room. Each fixture was equipped with four 100-watt lamps fitted with inverted translucent glass reflectors. There was a wainscot of white marble about 36 inches high along two sides and across the end of the room, while above this was a line of mirrors reaching to about 7 feet above the floor. The remainder of the walls and ceiling was tinted a light buff. The test results were as follows:

	Foot candles
Average intensity of illumination	5.78
Watts per square foot.....	1.875
Lumens per watt.....	3.08



Semi-Indirect Lighting in Grill Room, Hotel Sherman.

Another interesting series of tests was conducted, using prismatic glassware and tungsten lamps. The room was 18 feet 10 inches by 23 feet with a beamed ceiling 13 feet 10 inches—beams 15 inches by 5-5 inches on four-foot centers. The walls were of natural wood finish while the ceiling was painted white.

In the first case the units were hung in their normal positions and illumination measurements taken. Then the units were simply turned upside down and suspended by cords at a distance of 4 feet from the ceiling which happened to be about the same height at which the units were previously hung. Lastly, the reflectors were surrounded by a cone of bristol-board, the inside of which had been painted a dead black, the idea being to determine exactly what portion of the illumination obtained with the inverted system was due to reflection from the ceiling. The results are tabulated below.

	Effective lumens per watt	Maximum variation per cent	Relative efficiency per cent of direct system
Total indirect	1.027	78	33.75
Direct	3.04	55	100.0
Semi-direct .	1.54	44	50.6

Efficiency is unquestionably in favor of semi-indirect illumination as compared with indirect illumination.

The accompanying illustrations show lighting installations in well known hotels using direct, indirect and semi-indirect systems. The Hotel Sherman, Chicago, which is purchasing power from the Commonwealth Edison Company offers some interesting features in connection with hotel lighting.

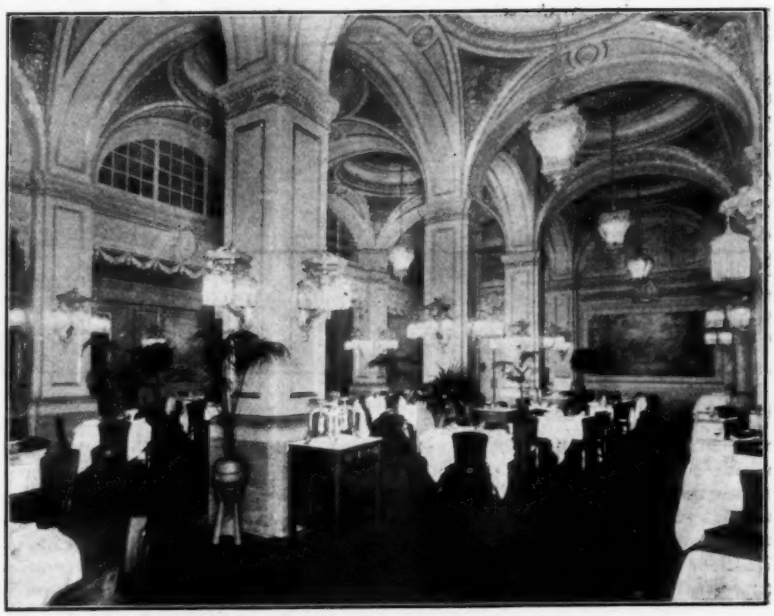
The basements, power plant, boiler room, etc., are lighted by means of inclosed arc lamps. The main lobby, a view of which is shown in one of the accompanying illustrations, is lighted by six ornate electroliers suspended from the ceiling, and four standard clusters on the short walls in front of the pilasters. The electroliers are each equipped with 55 40-watt frosted-globe tungsten-filament lamps.

The guest rooms, 757 in number, are all provided with large closets and private connecting baths. In each room there is an artistic central ceiling fixture, equipped with two 40-watt tungsten lamps, for the general illumination, and in addition a portable reading lamp containing a 30-watt clear globe carbon lamp, placed on the writing desk. Over the dresser, in each room, is provided a fixture containing two 25-watt clear-globe tungsten lamps and a bed lamp, 30-watt carbon, is also installed. One 25-watt tantalum lamp is placed in each closet and in each bath room are provided two 30-watt frosted-globe carbon lamps mounted on rods on each side of the mirror and so arranged that the person using the mirror can raise or lower the lights to a suitable position.

A feature of the guest-room lighting is the automatic control of the lamps in each room. For this purpose each corridor door is equipped with a door switch installed in the keeper of the door lock. The regular push-button switch installed in the room has an electromagnetic attachment controlled by the door-bolt switch. Locking the door on the outside extinguishes the lights, but locking or unlocking them from the inside does not affect them. When the room is occupied the lights are entirely under the control of the occupant, by using the room switch.

The average area of the guest rooms is 300 square feet and the average wattage installed 190, not including bath-room and closet lamps.

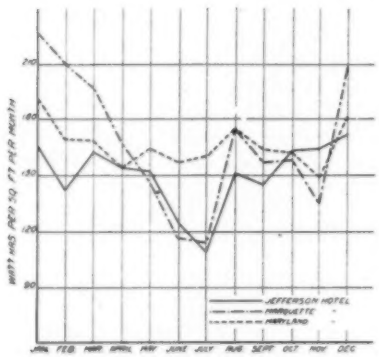
Some of the important departments of the Hotel Sherman are equipped with lamps as follows: College Inn, floor area 7,566 square feet, equipped with 51 25-watt round frosted-globe tantalum lamps, 300 25-watt tungsten lamps, four 40-watt tungsten lamps and 118 30-watt clear-globe carbon-filament lamps. The total wattage installed is 12,475. Portable candelabra using tallow candles are used for table lighting.



Italian Room of Hotel Sherman, Chicago.

College Inn private dining rooms, total floor area 768 square feet, equipped with 19 25-watt clear-globe tungsten lamps, 24 25-watt and 14 40-watt frosted-globe tungsten-filament lamps. The average monthly energy consumption of these rooms is 168 kilowatt-hours, while the average consumption of the College Inn proper is 5,100 kilowatt-hours per month.

The Celtic Café has a total floor area



Curve Showing Watt-Hour Consumption per Square Foot per Month for Three St. Louis Hotels.

of 1,950 square feet and is equipped with 120 25-watt tungsten lamps with round clear globes. The approximate monthly energy consumption of this installation is 945 kilowatt-hours.

The Italian Dining Room derives the greater portion of its light from artistic lanterns suspended from the ceiling, each lantern containing a number of incandescent lamps. The total installation comprises 65 25-watt clear-globe and 175 25-watt frosted-globe tungstens, the total wattage being 6,000. The floor area of this room is 3,120 square feet. The average energy consumption per month is 1,598 kilowatt-hours.

There are two barber shops in the Hotel Sherman, one designated as the College Inn shop and the other as the Clark Street shop. The floor area of each its about 1,024 square feet. The Clark Street shop is equipped with 25 25-watt tungsten lamps, while the College Inn shop has installed 66 25-watt tungsten-filament lamps and six 60-watt carbon lamps. The average consumption per month of the latter is 1,290 kilowatt-hours.

The Celtic, or Randolph Street buffét has a floor area of 1,950 square feet and is equipped with 97 25-watt clear round-globe tungsten lamps. The Italian, or Clark Street bar, which receives natural light on two sides, is equipped with 20 25-watt tungsten lamps of the round-bulb type. The floor area of this room is 752 square feet. The average monthly consumption is 945 kilowatt-hours.

The banquet hall of the hotel has a floor area of approximately 8,574 square feet and together with the banquet-hall kitchen is equipped with 459 25-watt clear-bulb, 15 25-watt frosted-globe, 37 40-watt clear and 10 40-watt frosted-bulb tungsten-filament lamps, and 102 30-watt carbon lamps, the total wattage being 16,790. The average kilowatt-hour consumption per month in these rooms is 1,113.

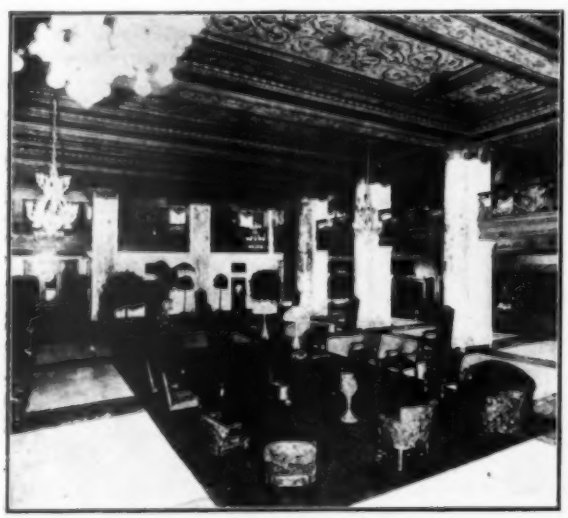
The distribution of lamps in the various service rooms and the approximate consumption per month is given in the table.

Department	Area Square Feet	25-watt tantalum	25-watt tungsten	40-watt tungsten	60-watt tungsten	60-watt carbon	30-watt carbon	100-watt tungsten	Kilowatt-hour consumption per month.
Lobby	6318	..	..	500	..	..	...	..	6300
College Inn	7565	..	351	4	..	..	118	..	5100
Celtic Cafe	1950	..	120	..	..	..	..	..	945
Italian Room	3120	..	240	..	..	..	..	..	1598
College Inn Barber Shop.	1024	..	66	..	..	6	..	..	1290
Clark Street Barber Shop.	1024	..	20	..	..	..	..	..	....
Clark Street Bar	752	..	44	..	..	...	..	..	945
Randolph Street Bar	1950	..	97	..	..	..	..	..	....
Laundry	4500	10	40	5	..	4	5	4	595
College Inn Kitchen	...	15	70	6	..	12	..	..	2830
Engineer's Dept.	...	14	75	7	..	5	10	..	2146
Printer	352	..	..	5	..	2	..	..	3
Wine Room	450	..	18	4	..	..	..	..	339
Store Room	....	..	40	6	..	2	..	..	480
Banquet Halls & Kitchen.	8574	..	464	47	..	..	102	..	1113
Help's Hall	...	..	67	..	..	..	..	..	....
Help's Quarters	...	25	36	18	2	2	6	..	....
Annex	...	..	50	..	..	5	..	..	....
Private Dining Room, College Inn	768	..	43	14	..	..	..	..	168

An installation that is really notable for its pleasing effect and comfortable quality is that in the Louis XIV café of the Congress Hotel. A view of this room with its eight graceful pedestal-vases among the tables on the floor is shown in one of the illustrations.

The room measures 37 feet by 95 feet, with a ceiling 20 feet high, divided by three-foot beams into seven equal panels. In the walls, opposite each ceiling panel, are the recesses containing the tapestried windows and wall areas, the curtains being red, while all of the wall and ceiling surfaces are of cream white.

The lighting standards themselves are of a pure white finished cement



Lobby of Hotel Sherman, Chicago.

Semi-Indirect Lighting in Hotel Sherman Buffet.

molded in graceful designs. The tops of the bowls are 30 inches in diameter and are 8 feet 6 inches above the floor. Each contains four 400-watt tungsten lamps set vertically in individual "X Ray" reflectors and from no position do they give any direct evidence of the flux of light which they project on the ceiling. There are eight of these pedestals, aggregating 12,800 watts for the total indirect illumination of the roof, which is equivalent to 3.6 watts per square foot.

Ranged on the 16 candelabra fixtures on the walls of the room are groups of 10 frosted 25-watt tungsten lamps, each lamp having a red shade. These fixtures are, however, not commonly used.

In one of the illustrations is shown a view of the Grecian Marble Café of the Blackstone Hotel. This particular installation is one of the most atractive in Chicago and has drawn comment from illuminating engineers in all parts of the country. The ceiling in this room is divided into comparatively small and very deep panels, and is finished in ivory white. The fixtures consist of shallow bowls suspended by bronze chains. Each bowl contains 20 indirect lighting units, consisting of 60-watt tungsten lamps, with clear bulbs and reflectors. The room is 47 by 50 feet, with a 16-foot ceiling. The bowls are hung four feet from the ceiling, there being six of them in the room. It is generally conceded by architects that pure classical architecture furnishes one of the most difficult of all problems to handle with respect to artificial lighting. The methods used in ancient Greece were so absolutely inadequate and unadaptable to modern conditions as to render them out of the question as models. The only alternative is, therefore, an adaptation of twentieth century lighting units to an architecture 20 centuries old. The indirect method of illumination possesses the unquestioned advantage of removing the actual sources from view, so that there is no possibility of a direct suggestion of incongruity, while the general diffusion of the light after the manner of daylight brings out the architectural features in their proper perspective and relations.

Another strictly classical and equally magnificent room is that shown in another illustration, which is utilized as a grill. The indirect lighting here is of a decidedly novel and interesting character. The ceiling is broken up into a large number of shallow polygonal panels, at the chief intersecting points of which are suspended single tungsten lamps and special indirect lighting units. From the engineering viewpoint this room is remarkable as showing the possibility of using the indirect lighting system with a highly decorated ceiling and units placed in very close proximity to it. Side brackets, with imitation candles, are used for purely decorative effect.

Commercial Practice
Management, Rates, New Business

CENTRAL-STATION SERVICE AS A FACTOR IN SCIENTIFIC MANAGEMENT.

By J. E. Bullard.

This is a day of scientific management. The subject has become so popular that many magazines contain articles and most of them contain advertisements of books dealing with the efficiency of labor. If the central-station man will take advantage of his opportunities this state of affairs will result in a very material increase of the power load. When the power salesman reads the articles and books published, he is struck by the great similarity between the arguments used by the conservation of human-energy advocates and those he has so often used to interest his prospect in the use of electric power. The purpose of this article is to point out some of the ways to take advantage of the interest aroused in this new efficiency movement.

F. W. Taylor, the pioneer in scientific management, writes: "The greatest prosperity can exist only as the results of the greatest productivity of the men and the machines of the establishment. Among the features which aid in bringing about this ideal condition are: (1) Convenient location of machinery. (2) Correct speed. (3) Good light. (4) Minimum time losses. We will now consider each of these four features and see how necessary is central-station service to their realization.

(1) Convenient location of machinery. One of the strongest stock arguments of the central-station salesman is that the use of motor drive makes it possible to arrange the machinery most conveniently. Motor drive does away with the necessity of locating the machinery near a line shaft. It makes it possible to locate it with reference to production rather than to the power-transmitting system. In order to obtain the greatest productivity of the men it is absolutely necessary to arrange the machinery with reference to production. If a man must take a truck and go to some other part of the shop for his material the productivity of both him and the machine will be low. If he has to wait till some one else brings the material to him the productivity is still low. If the helper who brings him material keeps him constantly supplied the man and the machine may have a high degree of productivity, but against this must be charged the unproductive labor of the helper. The only way to overcome this is to place the machine at the point where the material is. This is, as a rule, possible only when direct motor drive is used. This arrangement, however, means that the number of helpers can be greatly reduced and the total productivity of the plant greatly increased. The only factory lay out which will result in the maximum productivity of the men and the machines is as follows: The material must be received as close as possible to the first machine through which it is to pass. It must then pass from machine to machine over the shortest possible distance and with the minimum amount of manual labor till it leaves the last machine a finished product. This last machine should be as near as possible to the shipping room. In short, the material should be worked with from the time it enters till it leaves the factory, but should never be carried.

Every factory manager, in a more or less vague sort of way, knows these things are true. It is the work of the power solicitor to show him how they apply to his shop and his conditions. One of the best ways to do this is to make a time and space study of the factory. First of all make a careful study of the present route over which the material travels while in the process of manufacture. After this study draw up floor plans showing the location of the various machines and the route of the material. On this plan

with different colored ink relocate the machinery in such a way that the material route is as short as possible. Next spend a day or more in the factory with a tape line and a stop watch. Very carefully measure the distance over which the material travels and the time consumed in moving it. From these data figure out the time and distance which would be saved if the machinery was re-arranged in accordance with the new plan—a plan which is made possible by the adoption of electric drive. If there is any space saved ascertain the rental value of this space. Now figure out the distance in miles which can be saved annually. Add the annual saving in labor and the rental of the space saved. Compare this sum with the annual cost of electric power. Tabulate these results in such a manner as to make both them and the method of obtaining them as clear as possible. Present them to the prospect. Go over the figures with him and illustrate them with the floor and route plans. This may impress him to such an extent that nothing else will be needed to convince him of the advisability of making the suggested changes and adopting central-station service. In any case the time and money spent will be well repaid by the impression made on the prospect. He will see that the central station is working for his interest as well as its own.

(2) Correct speed. The scientific manager specifies the correct speed to be used for each operation. The specified speed will accomplish the desired result in the minimum length of time. Suppose, however, the speed varies with the load thrown on the machine. In other words, that as the load increases the speed slows down to a point below the specified speed. This is often the case. All power transmission systems have more or less slip. With the exception of gears, electric power shows the smallest percentage of slip with increase of load. Therefore, it is evident that electric power will result in the most constant speed. The difference in favor of electricity may be very great. For example, speed tests on looms have shown a speed variation in the case of belt drive as high as 15 per cent as against 2 per cent where direct motor drive was used.

In the past the power engineer, when he tested a plant, indicated the engine and placed a great deal of stress on the amount of friction which could be eliminated by the adoption of central-station service. There are many good prospects he has not been able to land with his old arguments. Let him now arm himself with a tachometer and a tachograph and place a great deal of stress on the labor saved by a more constant speed. It is a good plan to select a few of the best managed factories using central-station service and make a speed study of them. Select the types of machines used by the largest number of the prospective power users. Take speed readings on these machines under all conditions of load. Tabulate and average these results. Make similar tests on the same types of machines in the plants of the prospective customers. Tabulate and average these results. Now compare the two tables and figure out the annual money value of the labor which would be saved by the adoption of central-station service. In some cases this will amount to a sum greater than the total cost of the electric power. In other words, it will show that even though the present power may cost nothing it is still more expensive than central-station service. Suppose, for instance, electric power for a plant will cost $5.00 per day, the labor cost is $40.00 per day, and the present power supply has a speed variation of 10 per cent greater than the speed variation found in similar plants using central-station service. When the speed varies it means that a machine slows down when the load is thrown on. There is a certain maximum speed at which a machine will do good work. Therefore, it should not be operated at any time in excess of that speed. If a machine is started at that speed and slows down 10 per cent when the load is thrown on the result is the man and the machine do 10 per cent less work than they would do if the speed was constant. In short, in the case of our example, the $40.00 paid for labor results in accomplishing only as much as $366.00 would do with central-station service. The present power wastes $4.00 worth of labor per day. The present total power costs must not exceed $1.00 per day or the present system is more expensive than central-station service. Facts like these more than others have probably had most weight in keeping such users as woodworking plants on the central-station's lines. Any machine such as a saw, a loom, a planer, or a polisher, subject to great variations in load, will show vastly better results if driven direct from an electric motor than it will if belt driven from a long line shaft.

(3) Good light. No workman can do good work without good light. With a lot of moving belts and shafting in a room it is very difficult if not impossible to get good general illumination. Without good general illumination factory lighting is rarely satisfactory. This fact makes individual motor drive one of the essentials of good factory lighting. If, however, the current is taken from the motor circuits instead of from the lighting lines of the central station the variation and fluctuation in voltage will be great enough in most cases to make the lighting a failure. It is apparent then that the best results can only be obtained from central-station service. Very often as much if not more labor value is lost due to poor lighting than is lost due to poor power. The wide-awake power salesman will, therefore, utilize the light problem to aid him in installing a motor for each machine. It is comparatively easy to show that no manufacturer can afford to experiment with poor light. One way of doing it is as follows: Make time studies in the factory under different conditions of illumination. The instruments necessary are a portable photometer and a stop watch. During the different periods of the day measure the intensity of illumination and at the same time carefully take the time required by the workmen to do their work. Tabulate the results and determine the candlepower which would result in the greatest production per day. Figure up the money value of the labor which would be saved if the factory was correctly lighted. Also figure the cost of such lighting if supplied by the central station. The difference will often be great enough in favor of the central station to go a long way towards paying the central-station electric power bill. In any case, these figures will be more convincing than reams of ordinary arguments and if they do not alone result in the adoption of central-station service for all purposes will at least tend to prevent high light bill complaints. They will show that within reasonable limits the more money spent for light the cheaper is the lighting.

(4) Minimum time losses. The time lost due to power troubles depends on the reliability of the source of supply. In case of an engine and belt drive there is only one unit and all the machines obtain their power from one long line of shafting. This power system is the most unreliable of them all. The breaking of a belt or shaft may stop all the machines and cause the factory to shut down for several days. The slightest accident will cause loss of time on many machines. An isolated electric plant and motor drive eliminates the belts and shafting and is a great improvement. If, however, anything happens to the boilers, engines or generators the whole factory is shut down till repairs can be made. This may be hours, days or months, depending on how serious is the accident. With central-station service the number of units is greatly increased and the danger of a complete shut-down is correspondingly decreased. Each central station has several generating units and most companies have more than one station, or

at least a breakdown connection with other stations. Besides this the transmission systems are usually so arranged that the consumer can get his supply from any one of two or more directions. In short, he has the advantage of at least a complete duplicate power system. For these reasons the time losses in a factory using central-station service are either nil or much less than in the case of home-made power.

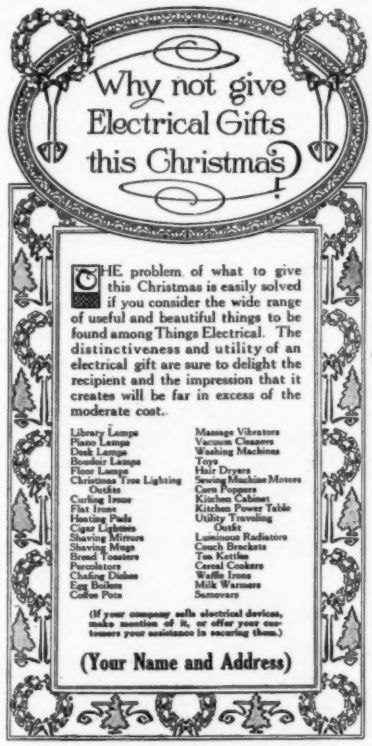
Summing up, we find that central-station service is a factor in scientific management for the following reasons: It admits of the ideal location of the machinery; it permits the nearest approach to the correct speed; it gives the best possible light; and it results in minimum time losses. Why then should we not co-operate with the advocates of scientific management and aid them in the endeavor to conserve both our human and our natural resources?

Co-Operative Central-Station Advertising.

It has been the custom for years for central stations to use a half page or more of newspaper space once or twice a year merely for the purpose of extending greetings to their subscribers and to thank them for their patronage. This use of space was not advertising—it was not expected to sell current and brought little returns. The more progressive companies have realized that this was inefficient and unprofitable and have made a decided change in their use of newspaper space.

The tendency today is toward the use of smaller space once or twice each week with carefully prepared advertisements covering the entire field of central-station advertising. They are advertising not only electric light and power but current-consuming devices of every kind as well. The current consumption of an electric truck will average about $250 per year and a pleasure vehicle about $60. The many household appliances, washing machines, vacuum cleaners, chafing dishes, bakers, broilers, toasters, fans, etc., allow the use of advertisements that accomplish two things—they assist in getting the appliances into use, thereby increasing the current consumption, and they emphasize the fact that the economy of the article advertised is only one of the many comforts and conveniences possible to those having electric light in their homes. They are showing store-owners that increased store and window lighting and sign lighting will augment their sales. They are showing factory owners that central-station power will in many cases cut their manufacturing costs. Naturally the up-to-date central-station manager finds it to his advantage to advertise the use of these and other current consumers.

The progressive manager is realizing that good newspaper advertising will bring him new customers and will also greatly increase the consumption of current by his present subscribers. It is this class of business—the increase in current consumption without the expense of installing new lines—that is particularly profitable. The Commonwealth Edison Company, of Chicago, cut its rates in half in the last five years and today finds the average amount per bill is more than ever before. Each consumer is using more than twice the amount of current used five years ago. A great deal of the credit for this must be given to the consistent advertising campaign maintained.


Why not give Electrical Gifts this Christmas
THE problem of what to give this Christmas is easily solved if you consider the wide range of useful and beautiful things to be found among Things Electrical. The distinctiveness and utility of an electrical gift are sure to delight the recipient and the impression that it creates will be far in excess of the moderate cost.
Library Lamps
Piano Lamps
Desk Lamps
Boudoir Lamps
Floor Lamps
Christmas Tree Lighting Outfits
Curling Irons
Flat Irons
Heating Pads
Cigar Lighters
Shaving Mirrors
Shaving Mugs
Bread Toasters
Percolators
Chafing Dishes
Egg Boilers
Coffee Pots
Massage Vibrators
Vacuum Cleaners
Washing Machines
Toys
Hair Dryers
Sewing Machine Motors
Corn Poppers
Kitchen Cabinet
Kitchen Power Table
Utility Traveling Outlet
Luminous Radiators
Couch Brackets
Tea Kettles
Cereal Cookers
Waffle Irons
Milk Warmers
Samovars
(If your company sells electrical devices, make mention of it, or offer your customers your assistance in securing them.)
(Your Name and Address)

Sample of Co-operative Advertising.

The cost of preparing advertisements, drawings, engravings and copy has heretofore made a consistent campaign almost impossible for any but the largest companies. A good advertising drawing costs from twenty to fifty dollars and when the cost of preparing copy, getting engravings, etc., is added, the total for a year's campaign of 125 or 150 advertisements is enormous. Co-operative advertising has solved this problem. By a number of companies throughout the country co-operating, they are obtaining this advertising at a very moderate cost. Such an arrangement is profitable for each central station participating and, by fostering a nation-wide advertising campaign, is also of considerable benefit to the electrical industry as a whole.

The first advertisements in this co-operative advertising service were used in July, 1912, and since that time the number of companies co-operating has been steadily increasing. The advertising is being prepared by the Wm. D. McJunkin Advertising Agency, of Chicago and New York, which has for years prepared the advertising for the Commonwealth Edison Company, of Chicago, the New York Edison Company and other lighting companies of similar standing.

Under this co-operative plan the companies are furnished with ten new advertisements each month which are prepared on timely subjects. A reserve supply of twenty-five advertisements is given when a central station enters upon the campaign, making a total of 145 advertisements supplied during the year. A matrix of each advertisement is furnished so there is no further cost for engraving. In a few of the smaller towns where the newspapers cannot use matrices, electrotypes are supplied. A valuable feature of the service is the fact that while the matrix, or electrotype, is made of the illustration only, a proof of each advertisement is furnished complete, showing both drawing and copy, style of type and set-up, etc. Thus the central-station manager can add any special offer he may have to make, revise, or entirely rewrite the copy if he wishes to do so. Many of the large companies who have advertising departments prefer to do this.

Besides the efficiency and economy of these advertisements, it is, beyond doubt, a great benefit to the industry, to have this advertising used in all parts of the country. It is educating the general public on the value of using electric current in ways they have never thought of before. The advertisements cover a variety of subjects, ranging from house lighting to factory power and from cigar lighters to electric trucks, but they always keep in the foreground the convenience and economy of using electric current. An advertisement may feature a heater, washing machine, boiler, etc., but only to emphasize the fact that it is only one of the many ways of saving time, trouble and money possible to those using electricity.

Peoria Electrical Page.

The Peoria electrical contractors in connection with the local lighting company have an electrical page in one of the daily papers, three issues having already been published. The advertisers rotate the spaces so each one has a different space each week till all the positions have been used, thus no one has an advantage over the other. It is planned to continue this page for a year.

Electrical Construction

FIRE ALARM SYSTEMS.—VI.

The Edwards Central-Station System and Sundry Apparatus.

In view of the fact that most of the small towns and villages have a fire department, and of the very great importance of getting the entire fire-fighting equipment to the location of the fire as quickly as possible after its discovery, it is rather surprising that

Fig. 1.—Recent Types of Signal Boxes.

there are so many small towns without any adequate or reliable means of giving alarms of fire. Some of the makeshifts for fire-alarm systems found in such places are unique for their crudeness, and very often, too, they are equally so for their lack of effectiveness in fulfilling the purpose for which they were designed. A town of several thousand inhabitants is recalled in which the apparatus for sounding alarms of fire consists of massive rings of steel, said to be locomotive tires, hung up at various street corners throughout the place. Anybody wishing to give an alarm is supposed to pound on this metal with a heavy hammer, which swings conveniently near, until the fire engines arrive. In other places the rapid ringing of some par-

Fig. 2.—Printing Register.

ticular church bell or other is the signal of fire, and in others still the signal is given by the ringing of a bell at fire headquarters or, perhaps, by the blowing of a whistle somewhere.

All such alarm systems as these lack the highly essential qualification of properly indicating the location of the fire. That the alarm indicate approximately, at least, the location is but little less important in the case of the small town or village than in that of the largest city, for here the fire department is usually made up largely of volunteer firemen working and living at various places away from fire headquarters.

Manufacturers have developed reliable, inexpensive systems which, by the ringing of a loud bell or in some other similar way, point out the location of the fire even when the installation does not include street signaling boxes at all. While it is not intended to recommend these as a substitute for installations including street boxes,

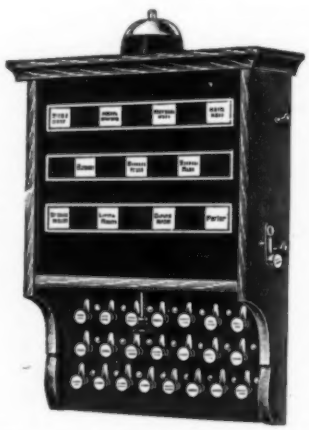


Fig. 3.—Annunciator with Alarm-Bell Switches.

where the expense of box installation cannot be afforded the adoption of a system like this would seem to be highly desirable. A system known as the Edwards central-station fire-alarm system, which, along with the other Edwards fire-alarm apparatus, is sold by the Western Electric Company. makes use of a so-called contact box installed in the local telephone exchange or in some other place at which alarms can be conveniently received on the telephone. The contact box is somewhat like a standard street signaling box, an important difference being that instead of a single code wheel the contact box contains a signal shaft on which the telephone operator or other attendant may slip at will the code wheel corresponding to the number of the district in which the fire has broken out. The territory to be protected is divided up into several small districts, each one of which has its own number. When news of a fire is received on the telephone the operator inserts the proper number wheel in the contact box, and by pulling a lever down sets the box going. The alarm and the location of the fire is then transmitted to fire headquarters and to whatever other points there are where receiving apparatus is installed, in a manner that may be readily understood from the preceding articles on the subject of fire-alarm systems. The receiving apparatus may consist of a tower-bell striker like that shown in Fig. 4. Strikers of this sort are operated by clock movement, but the control of the movement and thus the timing of the strokes of the bell are governed by the electric-current pulses in the circuit of which the number wheel in the contact box is a part. Where it is desirable to do so, either a single-stroke bell or a printing register—or both of these, if they are wanted—may be connected up at fire headquarters for giving the alarm there.

Fig. 4.—Electro-Mechanical Bell Striker.

It should be noted also in this discussion that the contact boxes referred to can be used on either a closed-circuit or on an open-circuit alarm line. For closed-circuit operation notched number wheels are provided, while on an open-circuit line number wheels having teeth are employed. Further-

more, street signaling boxes can be connected in circuit with the contact box, and, also, continuously ringing bells operated by local batteries cut into circuit by means of relays may me installed in the residences of firemen or at any other desirable locations. Fig. 7 is a rough diagram of the circuits of a system containing a contact box *A*, a single-stroke bell *C* for sounding the location of the fire, one street box *B*, and a local continuously ringing bell *D*. If other signaling boxes were needed they would be connected in series with *A* and *B*.

What most engineers would doubtless consider a high-class installation for a small town in which the firemen were mostly volunteer members of the department would be a closed-circuit system made up of a liberal supply of properly distributed street boxes, a single-stroke bell and pen register in

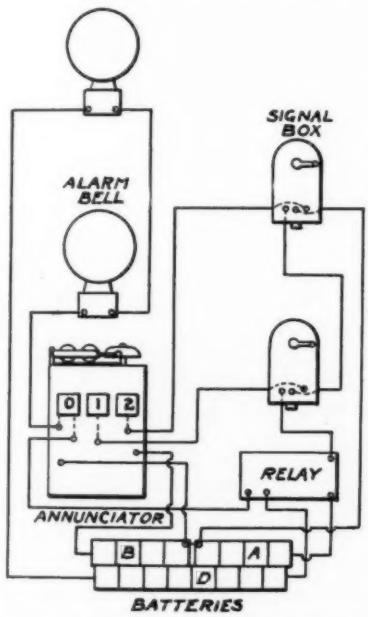


Fig. 5.—Circuits of Factory Alarm System

the headquarters of the fire company, and a large bell and striker in a tower at some good location. Where energy for charging them was available, storage cells would generally be employed as the source of current.

The street signaling box recommended for the sort of service considered above differs materially from any box described heretofore. The signal box itself, which is rather small, is placed inside a larger weatherproof case, the door of which can be arranged for opening by almost any of the methods employed in opening fire-alarm boxes. In the front of the signal box there is a glass window, and the breaking of this window relieves a spring which, before the window is broken, holds the clock mechanism of the box at rest. Thus by the breaking of the glass the clock movement is released, and the box set in operation.

The operation of the larger box in Fig. 1 is practically as just described,

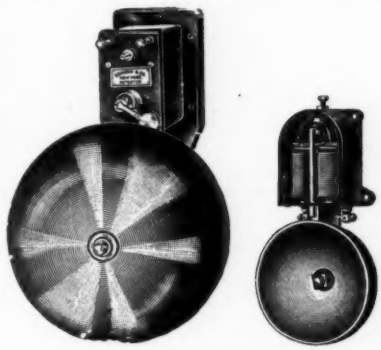


Fig. 6.—Alarm Bells.

this being another Edwards box used extensively in installations for the protection of factories or other industrial or private plants. It is interesting to note in this connection that this type of box has been approved by the state labor commissioner of New Jersey, where a state law requires the property owner to install a local fire-alarm in factories and other places where it is needed for the protection of life. The system designed by the Edwards Company for factory use, and approved by the New Jersey authorities, includes signal boxes of the type mentioned,

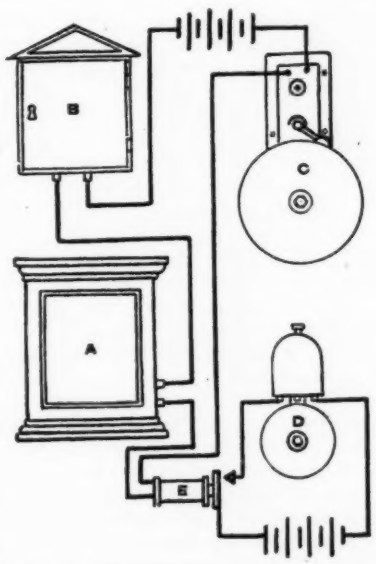


Fig. 7.—Alarm Circuit with Contact Box.

a fire-alarm annunciator and bell, bells for sounding the alarm in various locations throughout the plant, and a relay and batteries for operating this apparatus. The relay is operated by the current in the signal-box circuit, and it in turn controls the flow of current in the circuit of the alarm bells scattered over the plant. The circuit connections are shown in Fig. 5, but the boxes in this diagram are the "Mesco" boxes of the Manhattan Electrical Supply Company, which concern also supplies complete systems meeting the requirements of the New Jersey law.

In both the Edwards and the Mesco boxes keys are supplied for making tests on the circuits whenever these are thought to be necessary.

As may be seen from the diagram, three sets of batteries are used; batteries *A* are for the signal boxes, batteries *D* for the alarm bells, and batteries *B* supply current to the annunciator. When a signal box operates, the proper drop on the annunciator falls and sets the annunciator bell to ringing. An extra drop—which in Fig. 5 is marked *O*—is provided on the relay always. In case a battery fails or an accidental break occurs in the fire-

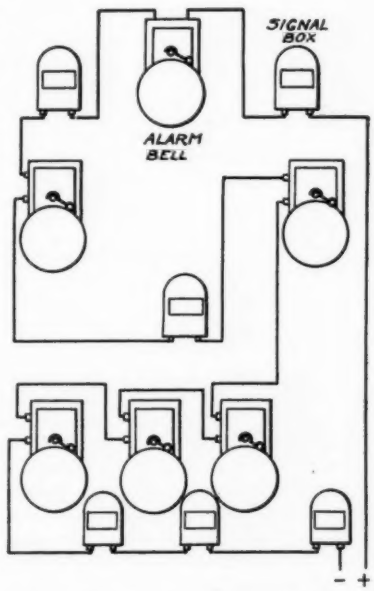


Fig. 8.—Simple Closed-Circuit System.

alarm circuit somewhere, this drop falls and the annunciator bell is started to ringing.

Fig. 8 is another diagram of an interior closed-circuit fire-alarm system. This system is one of the simplest, consisting as it does only of signal boxes and single-stroke alarm bells, all connected in series. Current for such a system would usually be supplied from batteries, and these would be connected between the leads marked positive and negative in the figure. The pulling of a signal box would cause all the bells in the circuit to sound the box number.

Where open-circuit alarm systems are employed in factories, hotels and similar places, it is frequent practice to mount an alarm bell at each signal box

and to install an annunciator in some room where an attendant is always on hand, the annunciator containing switches, by means of which the attendant could ring any desired alarm bell, and also a single switch for sounding all the bells simultaneously. When a box is operated, the annunciator indicates the location of it to the attendant, who promptly transmits the alarm to the proper place or places.

Electrical Construction in Mexico.

Interesting features of the banquet of electrical men of Mexico, held on the evening of December 5 at the Salon Bach in the City of Mexico, were addresses delivered by H. M. Stringfellow, engineer of the Mexico Tramways Company, Limited, and Percy Griffith, superintendent of power distribution of the Mexican Light & Power Company, Limited. These two companies belong to what is known as the Pearson syndicate, of which F. S. Pearson is the head.

Mr. Stringfellow in his address described certain features of the construction work of the new interurban electric lines which the Mexico Tramways Company is constructing from the capital to Toluca and Puebla. He said:

"It is a proven fact that practically all the mechanical wear under the rail is due to the motion permitted by the looseness of the present method of fastening, and experience has shown that the screw spike has a holding power to withstand the continued wave motion of the rail. The ordinary spike, the holding power of which is due to friction alone, is capable, when newly driven in sound timber, of holding the rail for a few weeks, but the screw spike remains tight, due to its threads, which mechanically lock in the fibers of the ties until decay sets in. Among other advantages of the screw spike are that once the track is lined it is much stiffer laterally and does not get out of line, due to the difference of temperature, as is often the case with the ordinary spike. Another very important feature of the screw spike is safety, as the holding power laterally is between four and seven times as great, and the holding power from a vertical pull four times as great. The cost of laying track is naturally somewhat higher, as well as the cost of the ties and the spikes."

Mr. Griffith spoke of the overhead construction and among other things said:

"The Toluca line ultimately will be about 66 kilometers long, and up to the present time it extends only to Cuajimalpa (Contadero), or about 15 kilometers out of Tacubaya. The line is of single-bracket construction. The poles are 40 feet long, with eight-inch tops. Each and every pole installed had previously been creosoted with 18 pounds of creosote to the cubic foot, and we expect these poles to last fully 15 years under ordinary conditions of service.

"The trolley and the messenger are insulated for 1,200-volt working pressure. The trolley wire is between 18 feet 6 inches and 19 feet above the rail. On curves where poles are on the inside of the curve we have set double poles for cross-span on account of trolley wire not lining up with the messenger cable and pulling itself in toward the poles. Where poles are on outside of curves we pull the trolley in from same poles without cross-spanning. On curves we used a pull-off hanger which is held in place by pull-off of steel cable.

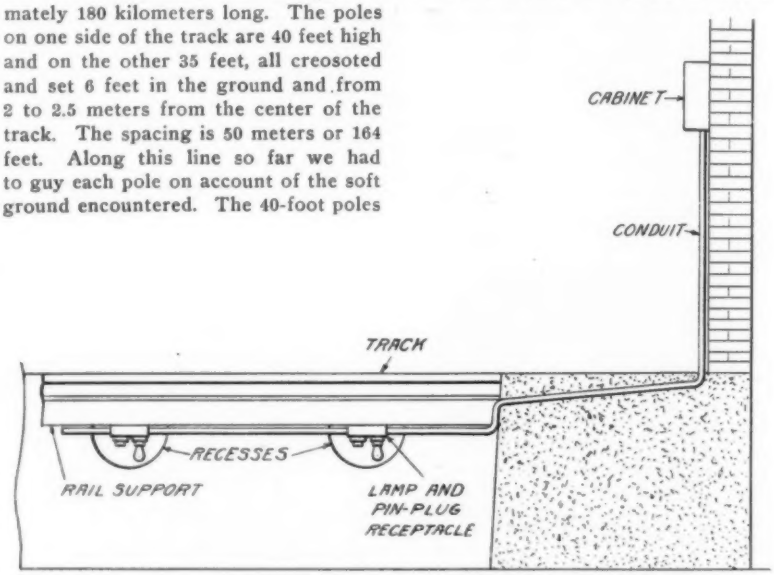
"The Puebla line, running from Xochimilco through the saddle between the two mountains, will be approximately 180 kilometers long. The poles on one side of the track are 40 feet high and on the other 35 feet, all creosoted and set 6 feet in the ground and from 2 to 2.5 meters from the center of the track. The spacing is 50 meters or 164 feet. Along this line so far we had to guy each pole on account of the soft ground encountered. The 40-foot poles carry at the top two 20,000-volt lines.

"One of the great difficulties attending the construction of lines of this character was that the fills, cuts, grading and overhead construction had to go ahead at the same time. That is, after the grading was finished, the poles had to be set and when the grading was finished the track department wanted power and as track could be laid quickly it was impossible to pull through messenger and trolley wire in time to give power in order to carry rails and material for track laying. So when poles were up, we strung an ordinary steel or copper wire along the poles on goose-neck insulators. When the motors came along we furnished them with a line to stretch from the trolley pole to the wire, holding it to the wire by a wooden rod or stick and ran along in that fashion."

WIRING IN CAR-BARN PITS.

By H. G. Wilson.

Of the many different methods in use for wiring pits in car barns, the following appears to be one of the best, as all the material that is most likely to be damaged is well protected from mechanical injury. As the illustration shows, there is a cutout cabinet on a side wall from which the conduit is run down the wall and through the floor to the pit, in which it is securely strapped to the lower edge of the wood rail support at the top of the pit sides. At the desired location for light and extension outlets, the concrete, directly beneath the rail support, is hollowed out in a recess of circular form to a depth of six inches and a width of about 10 inches. Conduit fittings are used to break around the edges of the recessed portions and the usual fittings employed for the lamp-base and pin-plug connectors. These were especially designed of extra heavy material, since it was decided that the extra first cost would be more than offset by the saving in cost of repairs which the necessarily rough service would make necessary if the ordinary fittings were used.



Position of Fittings in Wiring Pit.

Telephone Wire in Lighting Circuits.

It is stated that the bureau of electrical inspection of Atlantic City, N. J., has recently sent out some fifty notices to owners of various buildings, in which it has been discovered that for the purpose of saving expenses, telephone wiring has been used for conducting electric light current. The bureau has ordered out all of this wiring.

EARTHED VERSUS UNEARTHED NEUTRALS ON ALTERNATING-CURRENT SYSTEMS.[1]

By J. S. Peck.

The questions where, when, and how should the neutral point or points of an alternating-current system be earthed are highly controversial ones, and though they have been discussed a number of times before the technical societies, there are still wide differences of opinion among operating engineers as to the proper course to follow under different conditions. While it is difficult to give general rules covering all cases, there are certain conditions where the proper course to follow seems clear, and it is intended in this paper to discuss the various questions involved, and to show why under some conditions of operation it is becoming general practice to earth the neutral, while under others it may be advisable to operate with the neutral unearthed.

Three classes of apparatus or systems will be considered: (1) Generators. (2) High-voltage transmission circuits. (3) Low-voltage distribution circuits.

Before considering these three classes separately, the general advantages and disadvantages of the earthed neutral which are common to them all will be considered.

While several advantages may be claimed for the earthed neutral, there are but two which are really of any great value. These are: (*a*) The limiting of the voltage between line wires and earth. (*b*) The possibility of cutting off any wire or feeder in the event of an earth upon it. The chief objection to earthing is the fact that the system cannot be operated with an earth on any line wire.

It is well known that in an unearthed three-phase system, where the impedance of each phase to earth is equal, each of the three conductors assumes a potential above earth equal to 58 per cent of the voltage between wires while the neutral point is at earth potential, but any difference in the impedance causes the potential of the neutral point to shift, bringing the phase having least impedance nearer to earth potential and raising the others to a potential correspondingly higher above earth. When one phase is earthed, it assumes earth potential, and the other phases reach full-line potential above earth. When the potential of each phase to earth is the same, the charging current to earth will be equal in all phases, but when one phase is earthed the charging current to earth is increased by 73 per cent in both of the unearthed phases, and all of this current will return to the generator through the earthed phase and will pass into the faulty wire at the earthed point.

Earthing the neutral means this point is fixed at earth potential, and the three line wires are fixed at a potential 58 per cent above earth.

If the neutral point is earthed through a resistance and one phase is earthed, current flows through the neutral resistance, and the drop across this resistance measures the voltage between the neutral point and earth, so that the neutral point is not fixed definitely but depends upon the amount of resistance and the current flowing through it. Thus the conditions are intermediate between those with the unearthed neutral and with the neutral solidly connected.

With the earthed neutral very simple and reliable apparatus can be provided, which will cut out any feeder in case an earth occurs upon it. This apparatus may be of the Merz-Price balanced protective type, or it may be of that type which is based upon the principle that the resultant current in a three-phase circuit is zero. Still another possibility is to put a trip coil in series with the earth connection, but this arrangement is not so satisfactory as those previously mentioned, in that it does not discriminate as to the feeder to be cut off.

Generators.

All modern three-phase generators are insulated to stand operation without the neutral being earthed, so that no consideration of reduced first cost due to limiting the voltage to earth by earthing the neutral need enter the problem. Also the question of risk of breakdown with earthed or unearthed neutrals may also be practically neglected.

When deciding upon the advisability of earthing the neutral of a generator, consideration must be given to the service for which it is to be used. Three classes of service will be considered:

(*a*) Generator supplying network of underground cables.

(*b*) Generator supplying overhead transmission circuits without transformers.

(*c*) Generator supplying overhead transmission line through step-up transformers.

In case (*a*) an earth on any phase of a cable is almost certain to develop into a short circuit between phases, and on a large system the result of a short circuit on a cable is usually to burn off a section of the cable, perhaps to damage adjacent cables, and sometimes to set up surges which may cause serious breakdowns elsewhere on the system. Since the majority of breakdowns on cables are to earth, it is therefore extremely desirable that a cable be cut off as soon as an earth develops, and as this can be done quickly and with certainty where the generator neutral is unearthed, it is becoming general practice to do this in all stations of this class. Thus practically the only question to consider is whether the neutral should be earthed solidly or through a resistance, and, where there are several generators in parallel, how many of them should be earthed. The only object in inserting resistance between generator neutral and earth is to limit the rush of current which occurs whenever there is an earth on the system. If balanced protective apparatus is used, the resistance may be made so high as to keep down the current rush to a comparatively low value, because the protective apparatus may be set to operate with a very small unbalancing in current; but where plain overload protection is used—and this applies to the majority of cases—the resistance should be low enough to pass sufficient current to trip the breakers on the largest feeder, but high enough to prevent damage to generator windings, and, if possible, to prevent serious burning at the point of accidental earth.

In calculating this resistance, allowance should be made for the drop in voltage on the generator due to the load on one phase, also for the resistances in neutral earth connection in the feeder and at the point of accidental earth.

In designing the resistance, ample heat capacity should be allowed, for the circuit breakers may stick, or there may be at least temporarily a fairly high resistance at the point of accidental earth which will prevent the circuit breaker from opening immediately, and so give time for the resistance to reach a high temperature.

In general, earthing resistances are built up of cast-iron grids mounted on porcelain insulators, and should be located in a fireproof compartment. They are usually designed to have sufficient heat capacity so that full star voltage may be maintained across them for at least 15 seconds without a temperature rise of approximately 300 degrees centigrade being exceeded. The ohmic value of the resistance is determined by the current required to trip the breakers on the largest feeder.

Where it is desired to earth through a resistance, and two or more generators are operated in parallel, the simplest and best method in so far as earthing is concerned is to connect the neutral of all the generators to a common busbar which is earthed through a suitable resistance. Then, regardless of the number of generators, the value of the earth resistance will always be the same. With this arrangement switches must always be provided between each generator and the neutral busbar, otherwise a generator disconnected from the main bus and shut down may be raised to a dangerous potential above earth, in case of an earth on any feeder. The objection to this method of connection is that in certain cases very heavy currents may circulate

[1] A paper presented to the Institution of Electrical Engineers (British); slightly abridged.

through the neutral connections and generator windings, and while the deleterious effect of this current has been overestimated, it appears that in certain cases it has been almost impossible to operate with the neutrals connected solidly together. When the wave-forms of the different machines are exactly the same, no current can flow through the neutral connections, but when the wave-forms are different and there is a third (or multiple of three) harmonic present, current will flow through the neutral connection, the amount of which will depend upon the value of the third harmonic, the displacement angle, and upon the impedance which the generator offers to this current of triple frequency. Machines which at no load give no circulating current, may show heavy circulating currents as the load comes on, or *vice versa*. The amount of the circulating current also depends upon the adjustment of the field current of the different machines, and upon the angular variation in speed of the prime movers.

In certain abnormal cases the current in the neutral may amount to the full-load current of one generator or even more. It should be noted, however, that the neutral current divides equally among the three phases of the generator, so that full-load current in the neutral is equivalent to only 33 per cent full-load current in the windings of the generator, and since the heating in the windings is equal to the sum of the squares of the main and circulating currents, the resultant heating is increased by only 11 per cent—not a serious amount even with this very high value of circulating current. With 30 per cent of full-load current in the neutral the resultant heating in the generator is increased by only 1 per cent at full load and is quite negligible.

It would seem advisable, therefore, to try connecting the generator neutrals solidly together, especially in the case of turbo-generators, where there is no angular variation in speed, and therefore less chance of circulating currents. Should satisfactory operation be impossible, then only one generator should be connected to the neutral bus, or resistance may be inserted between each generator and the neutral bus.

Of the three methods, that of connecting the neutrals solidly together is undoubtedly the simplest and best, while the method of operating with an earth on only one generator comes next in simplicity. The switching on and off of the different generators to the neutral bus may be done automatically, or it may be done by hand. While the latter method depends upon the memory of the station attendant, or upon the systematic operation of the station, the fact that the attendant may forget to connect a machine to the neutral busbar does not mean disaster, as it is only in case of a cable breakdown that trouble may occur, and it must be remembered that many stations are operating successfully with an unearthed neutral.

(*b*) *Generators supplying Overhead Transmission Line without Step-up Transformers.*—In this case there are usually a comparatively small number of transmission lines, and an earth on one wire is not likely to cause a short circuit between wires, so that with an unearthed neutral it is quite possible to run for a long period with one wire earthed. If there are not sufficient feeders to all distributing centres to make it possible to cut out a defective one and deliver full load over the others, the possibility of being able to operate with one wire earthed may be sufficient far to outweigh the only practical advantage gained by earthing the neutral, which is the ability quickly to cut off a feeder in the event of an earth upon the wire. Limiting the voltage between each wire and neutral, which can be done by earthing the neutral, is of very little importance, since the voltage is in no case very high, and the generators and the line must be insulated to withstand strains set up by lightning discharges and other abnormal conditions. It would appear, therefore, that in the majority of cases the weight of the arguments is in favor of operating with the generator neutrals unearthed.

(*c*) *Generators supplying Transformer which Step Up to a very High Voltage for Long-distance Transmission.*—In this case there are conditions involved which make it extremely desirable to earth the neutral or else to earth the low-tension side of the transformers.

If one terminal of the high-tension side of a single-phase transformer be connected to a high-tension line, and the low tension be open-circuited, the high-tension winding assumes a potential above earth equal to that of the line to which it is connected. The high-tension winding then acts as one plate of a condenser, with the low tension and core as the other plates. The low-tension winding also has static capacity to the iron, and it will therefore assume a potential above earth the value of which will depend upon the relation between its capacity to the high-tension winding and its capacity to earth. In practice it may easily assume one-half potential of the high-tension winding.

If both terminals of the high-tension winding are connected to the high-tension lines, the resultant potential of this winding above earth will be zero, and the resultant potential of the low-tension winding above earth will also be zero. If, therefore, one terminal of a transformer be connected to or disconnected from a line before the other, the low-tension winding during this period may assume a very high potential above earth and its insulation be broken down to earth. When the low-tension winding is connected to a generator, the generator winding also has capacity to earth, so that the capacity of the low-tension winding to earth is increased by this amount and its voltage correspondingly reduced. But, while the voltage is reduced by connecting the transformer and generator windings together, it may still be dangerously high.

When both terminals of the high-tension winding are connected to the line and one wire is earthed, the resultant voltage of the low-tension winding will be one-half as great as before, but may still be dangerously high.

In the case of a three-phase transformer the conditions are much the same as described above for a single-phase transformer. If one terminal of the transformer is connected to the line, the whole of the high-tension windings will be raised to full-line potential above earth, and the low-tension winding will be raised to a correspondingly high value. If the three terminals of the high-tension winding are connected to the line and one line wire be earthed, the resultant potential of the high-tension winding will be 58 per cent of the line voltage above earth, while the low tension will be 58 per cent of its former value above earth.

It is evident that when the neutral of the high-tension system is unearthed there are several possibilities of obtaining a high voltage on the generator windings, viz., in the case of an earth on one high-tension wire, or in the case of the switches in the three phases not operating simultaneously. It is not necessary that a line wire should be permanently earthed in order to raise the voltage on the low-tension circuit, as a discharge over a lightning arrester may so disturb the static balance system as to produce a high potential on the low-tension winding.

A case is on record where several generators in parallel were supplying a very high-voltage line through step-up transformers. The neutral point of the generators was unearthed. The lightning arresters on one high-tension phase broke down and the generator windings were raised to a high potential. One generator broke down, and the attendant, seeing smoke, cut off the busbars. A second machine immediately broke down, and was in turn cut off. This was repeated until nearly all the generators in the station were broken down. The attendant then cut off the excitation. Had the neutral point of the generators or that of the high-tension side of the transformers been earthed, the trouble could not have occurred in the generator circuit. There is, however, a chance of similar trouble even when the high-tension neutral is earthed, provided the gen-

erator neutral is unearthed. This occurs when the insulation between the high- and low-tension windings of the transformer breaks down at one point. The low-tension winding then assumes the potential of the high-tension winding at the point of connection, and a breakdown on the low-tension system is almost certain to follow.

With electrolytic lightning arresters it is necessary to connect the aluminum plates to the lines at frequent intervals in order to preserve the film on the plates. These plates have a high electrostatic capacity, and a considerable charging current flows through the arrester while it is connected to the line. It has been found on one system that when the arresters are being charged, disturbances are set up on the system and breakdowns have occurred on secondary circuits. It is quite possible that this trouble is due to the static unbalancing of the high-tension circuits, which in turn raises the secondary circuits to a high potential above earth.

Where it is considered undesirable to have a direct connection between low-tension windings and earth, a spark-gap may be placed in the circuit and set to break down at a pressure slightly above the normal voltage of the winding above earth.

Another method of protecting the low-tension system in the case of breakdown between the windings of the transformer is the use of earth shields between primary and secondary windings. This system was at one time in general use in this country, but it is now scarcely ever called for.

Thus in the case of generators supplying a high-tension transmission line through transformers, it is highly desirable to earth the neutral point of the generators, and preferably through a rather low resistance. If it is not desired to connect permanently to earth, then a spark-gap should be used in the earth connection.

High-Voltage Transmission Circuits.

The argument in favor of earthing the neutral in the case of high-voltage transmission circuits are:

(*a*) The possibility of cutting off the circuit in case of an accidental earth on any wire.

(*b*) Reduced cost of transformers and of line insulators due to limiting the voltage above earth to 58 per cent of line voltage.

(*c*) Reduced cost and closer possible setting of lightning arresters.

(*d*) The possibility of using the earth as a conductor in the event of one line wire being disabled. This requires an earth at both ends of the line.

The argument against earthing the neutral is that an earth on one wire makes it impossible to transmit over the circuit.

(*a*) Whether there is any advantage in being able to cut off a circuit in the event of an earth on one wire depends upon the number of circuits available. In general, there are seldom more than two circuits to any sub-station, and often there is but one, so that cases may often arise where, to keep up the supply, it will be absolutely necessary to operate with one wire earthed. This method of operation would be impossible with an earthed neutral. Also an earth on one wire is not likely to develop into a short circuit between phases, so that there is no particular need for cutting off the earthed circuit.

(*b*) The higher the voltage of the transmission the greater will be the saving in first cost made by insulating the transformer for 58 per cent of the line voltage and by using line insulators for a corresponding voltage; but in general it is bad practice to adopt this expedient, for it may prove impossible to operate continuously with an earthed neutral, due to disturbances on adjacent telephone circuits which may occur under certain abnormal conditions, and in the event of an earth on one wire it may be essential to remove the neutral connection and operate with one wire earthed. In general it is poor economy to cut down insulation on either lines or transformers.

(*c*) If the system may sometimes be operated without earthed neutral the lightning arrester equipment must be suitable for this condition, so that there is no saving in first cost; but as long as the system is operating properly with earthed neutral the arresters may certainly be set for lower discharge values than when the system is unearthed.

(*d*) In the event of one wire on an earthed system going to earth, it would still be possible to transmit approximately two-thirds the full amount of power over the two remaining wires, provided the neutral points at both ends of the line were solidly earthed and one line with its corresponding transformers cut out of circuit. In this case the earth would carry full-line current, and in very few places would this be allowed on account of disturbances to neighboring circuits.

The neutral point of a high-tension system can be obtained only by connecting the high-tension windings of the transformers in star, or by the use of an auto-transformer, and this latter method is seldom if ever used. If the high-tension windings are connected in star, then damage to one transformer disables the whole group, while with the delta connection on both windings one transformer of the group may be cut out and approximately two-thirds the capacity supplied from the remaining transformers. (This does not hold in the case of three-phase core-type transformers, but is true for single-phase and three-phase shell-type transformers.)

The conclusions to be drawn from the above are that in the great majority of cases continuity of service will demand that the system be operated with an unearthed neutral, and that in general the transformers should be connected in delta on both high-tension and low-tension windings.

Distribution Circuits.

When it comes to a study of the question of low-tension distribution circuits, the majority of the arguments presented above will apply here also, but there enters one other consideration, *i. e.*, the danger to human life.

If the neutral point of, say, a 500-volt system is earthed, then the maximum potential above earth which any point of the system can reach is 290 volts. If the system is supplied from a 500-volt generator, the difference between a 500-volt and a 290-volt shock may mean the difference between life and death, or it may not, and there is certainly greater risk of shock from a system which is permanently earthed than from one which is earthed only occasionally. The higher the voltage of the generator the less will be the value of the earthed neutral in preventing danger to life due to reducing the voltage to earth.

When the distribution circuits are supplied through step-down transformers, there is always the possibility that the low-tension circuits may be raised to a very high potential, either through an earth on one wire of the high-tension system, or through a connection between high tension and low tension inside the transformer. In the former case there is great danger to low-tension insulation, and in the latter there is danger to life as well as to insulation.

Thus, where the distribution circuit is supplied direct from a generator, the advantages of the earthed neutral are the ability quickly to cut off a defective circuit and a possible reduction in risk to life, due to lower maximum voltage to earth; but where the circuit is supplied through step-down transformers from a high-voltage line, there is danger to life and apparatus if the neutral is not earthed.

Where a single-phase circuit is supplied from a single-phase transformer, the low-tension winding should be earthed, preferably at the middle point of the winding, but it is better to earth one line wire than to leave the system unearthed.

Conclusions.

(1) *Generators.*—When generators supply a system of underground cables, the neutral should be earthed through a resistance. This makes it possible to isolate a cable in the event of an earth on any phase before such an earth develops into a short circuit.

When generators supply overhead circuits, it is a question of balancing continuity of service against the abilty to cut

off a feeder in case of an earth upon one wire. If there are comparatively few feeders, and these of large capacity, the balance will usually be in favor of not earthing, but each case must be considered individually.

When a generator supplies transmission lines through step-up transformers, the neutral should always be earthed or connected to earth through a spark-gap, otherwise the generator windings may be raised to abnormally high potential above earth. The neutral may be earthed direct, though a comparatively low resistance will usually be preferred.

(2) *High-voltage Overhead Transmission Lines.*—In this case the number of circuits supplying any particular district is ordinarily very small, and as an earth on any one wire is not likely to develop into a short circuit between phases, considerations of continuity of service will usually determine that the high-tension system should be run without an earthed neutral and with both windings of the transformer connected in delta.

(3) *Distribution Circuits.*—When the working circuits are supplied direct from a low-voltage generator, the advantage in earthing the neutral is the possibility of cutting off immediately any defective feeder, and when the necessary apparatus is provided for this purpose earthing will in general be preferred.

When the working circuit is supplied from a transformer stepping down from a high-voltage line, the neutral should always be earthed.

Among the Contractors.

A great deal of interesting electrical news has been forthcoming for some time past from Louisville, Ky., concerning the work which is being done by various prominent Ohio and Mississippi Valley contractors in equipping river craft with electric lights and connections for all the appliances and utensils of the home. The extent of the field for this work which exists along every navigable stream in the United States makes the subject an interesting one, and that the line is losing none of its importance is evidenced by the contracts secured only recently by the Marine Electric Company, of Louisville. This company, as its name indicates, specializes in electrical work upon steamboats and other craft. The company is now installing a five-kilowatt turbine generator set, wiring, lamps and a powerful electric searchlight upon the towboat "John Ewen," which plies the Mississippi river and which is owned by the Mississippi Commission. It is also installing a ten-kilowatt direct-current reciprocating unit, with arcs and incandescents, the necessary wiring and a 6,000-candlepower searchlight, upon the government boat "Istaquena," which is used to transport congressional inspection committees up and down the Mississippi. Still another contract under way is the wiring of the freight depot of the Louisville & Nashville Railroad Company at Pullman, Ala., iron conduits being used, and a similar job for the Louisville & Nashville road is being installed by the Marine force on the train shed at Decatur, Ala.

L. B. Van Nuys, secretary of the Peoria (Ill.) Electrical Contractors' Association, reports that this organization is making splendid progress and that the members are very enthusiastic over the work of the association. A special meeting was held December 13 to begin preparations for the convention of the Illinois Electrical Contractors' Association, which will be held in Peoria January 17-18, 1913. The Peoria members will spare no effort to make the convention successful in every way.

Business is booming with electrical contractors in Cincinnati, O. One of the biggest building years the Queen City has enjoyed in recent history is now on and new contracts are a matter of daily occurrence with the electical contractors. The Beattie Electric Company has secured a contract for wiring and installing the necessary equipment in the new theater of the Boston Amusement Company, at Vine and Elder Streets. A. Wotiz has contracted for the electrical work upon the Liberty Theater, on Liberty Street near Baymiller Avenue.

The newest electrical contracting concern in Bowling Green, Ky., is the Farnsworth Electrical Company, headed by J. Bland Farnsworth. Mr. Farnsworth has had years of experience in the trade and is one of the best known electricians in Southern Kentucky. The headquarters of the concern have been established permanently in the McAuliffe Building.

Blumenthal-Kahn Electric Company, Baltimore, Md., has been awarded the contract for the electrical installation in the round house of the Western Maryland Railway Company at Hagerstown, Md. The contract is a very large one and the installation calls for a large quantity of all sizes of wire from 250,000-circular-mil lead-incased to No. 8 stranded. All panel boxes will be slate-lined and the work will be done under the supervision of the G. E. Painter Company, consulting engineers. The Blumenthal-Kahn Electric Company also has the contracts for the electrical work in the new passenger stations at Hagerstown and Cumberland for the same railroad company.

The equipment of the physics department of the Louisville Girls' High School, in Louisville, Ky., is to be done by Childers & Waters, who will supply a 1.75-kilowatt, 110-volt direct-current generator, direct-connected with a three-horsepower, 220-volt, 60-cycle, two-phase motor, and will install all the necessary wiring, lamps, instruments, etc.

G. M. Gest, conduit engineer and contractor, 277 Broadway, New York, has secured the contract to install the underground conduit and cable system for the Consolidated Gas & Electric Company of Long Branch, N. J. The amount of the contract is about $50,000.

G. H. Gottschalk & Company, of Chicago, has awarded the contract for installing the wiring for 550 incandescent lamps to F. L. Decker, one of the electrical contractors of this city.

The White City Electric Company, of Chicago, is doing the electrical work in the Lake Michigan Building, Chicago. Some 800 incandescent lamps will be installed.

The Electric Construction Company, of which Irvin W. Nye is manager, has recently enlarged its store space at 26 North Fifth Street, Reading, Pa., and, in addition to a general electrical construction business, is handling a complete line of fixtures and supplies.

Charles Elliott & Company, electrical contractors of Baltimore, Md., applied to the United States District Court on November 27 for the benefit of the bankruptcy law. The liabilities amount to $12,845.42 and the assets to $4,478.29.

Benjamin F. Sprague, electrical contractor, Long Branch, N. J., has been awarded the contract for the complete installation of the wiring and fixtures for the new Grand Theater, in Long Branch. There will be a total of 1,200 incandescent lamps.

Henry Newgard & Company, of Chicago and Milwaukee, is wiring the Rumly Building, in Chicago, for 500 incandescent lamps.

W. H. Mutchler, of Easton, Pa., is rewiring the Northampton County court house, which is located in the city mentioned. A new installation for the entire building will be put in.

The Wadeford Electric Company of Chicago, is wiring the supply department building of the Board of Education in this city for 600 incandescent lamps and one motor.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
JAMES BENNETT, vice-president, 524 Coristine Building, Montreal, P. Q.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham Street, Boston, Mass.

Executive Committee:

H. S. WYNKOOP, chairman, 13 Park Row, New York, N. Y.

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, W. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, T. Henry Day, James E. Cole, Thomas D. McColl

Secretary's Message.

The Secretary has only a few words to say about the questions appearing in this number. Question 208 is clear enough and requires no comment. Question 209 is interesting and a study of the accompanying diagram will show the condition. In connection with the question attention may be called to the sixth answer, which suggests the hypothetical nature of the question, but the Secretary can only say that the question was not hypothetical but sufficient cause of controversy between inspector and contractor for the work of installation to be held up pending settlement. Question 210 obviously is not one on Code interpretation, but was included by special request in spite of that fact.

The Secretary regrets the irregular appearance of the Association matter the last few times and can only humbly ask to be forgiven, and promise to try to do better in the future.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Installing Sign-Lighting Transformers.

Question 208. Is it necessary to place a slate slab in back of a small sign transformer (500 watt) when placed on a building? Transformer is inclosed in an iron case and supported an inch and a half away from the building.

Answer 1 (O). Rule 36*c* requires transformers of this class to be one foot from combustible material or separated therefrom by a slab of slate or other approved material. We would not consider the fact that the transformer is on the outside of the building to make any difference in this case, as the work is essentially a part of the electrical equipment of the building, and Rule 36 is the only rule covering the case.

Answer 2 (H). If the building is of brick or stone and the transformer referred to is on the outside of the building, a slate slab would not be necessary. The particular danger from such transformer is of its burning out and setting fire to the building on which it is placed; on a wooden building some fire protection would be advisable.

Answer 3 (F). Sign transformers should be treated as resistances and equalizers, and installed as per Rule 4*a*, National Electric Code.

Answer 4 (K). The National Electrical Code, as we see it, does not require the use of a slate slab in the case in question. If the transformer was separated from the walls of the building to which it is attached in a substantial way, we should not insist on the use of the slab.

Answer 5 (J). This case does not seem to be specifically covered by the Code rules on transformers. However, I should apply Rule 14*b* to the case in question. This rule, it will be remembered, requires supports for the transformer substantial enough for the weight to be carried, which would not be great, and prohibits attachment to a frame building when any other location is possible. If such attachment were found to be unavoidable, I would apply Rule 36*c*, notwithstanding that this rule is intended for transformers used indoors. Under Rule 36*c*, 12-inch separation from combustible material is called for, or else the slate, marble or soapstone slab is required.

Answer 6 (B). It is not necessary to install a slate slab in back of a small sign transformer (500 watts) when placed on a building; or in back of any transformer. By referring to Rule 14*b* it may be seen that the requirements relative to transformers under such conditions are merely that they "must not be attached to the outside walls of building, unless separated therefrom by substantial support", and "must not be attached to frame building when any other location is practicable."

Answer 7 (N). I can see no reason for the installation of a slate slab in such a case.

A Question of Motor Leads and Fuses.

Question 209. A certain three-phase motor starter requires three fuses or circuit-breakers, two of which are not in circuit while starting but only in the running position, the third being always in. The fuse which remains in circuit must have a capacity of two and one-half times the rated current of the motor. These fuses are between the starter and the motor.

(1) Should service fuses be required in the line at the service switch independently of these?

(2) Should the wires between the starter and the motor, which must have a capacity one and one-half the normal-current rating of the motor for running service, be considered properly protected by making all of the same-sized wire and placing in this wire a fuse of double capacity? or should this wire be itself of double capacity and normally fused?

Answer 1 (F). (1) Yes; Rule 8*c*, National Electrical Code, and Rule 23*a*.

(2) All wires should be of sufficient size to be protected by the fuses necessary to hold the motor under all conditions of its normal starting and running loads. Approved fuses should be in circuit (protecting all wires) both at time of starting and running.

Answer 2 (H). (1) They certainly should.

(2) No, because this would be overfusing the wire now protected by the cutout.

Answer 3 (E). My answer to the first paragraph of this question is Yes. In answer to the second paragraph, I would say that I do not think it best to overfuse any wire.

Answer 4 (O). The questioner seems unduly concerned in regard to the motor fuses used only to protect the motor in accordance with Rule 8*c*. These fuses, or two of them at least, are not in circuit during the period of starting, and, therefore, are not to be considered as protection for the wires leading to the motor. There must be fuses other than these motor fuses to protect all the wires leading to the motor, including the wires between the starter and the motor; or, in other words, no part of the circuit may be of wire of a size which will not be protected by the fuses necessary to carry the starting current (Rules 8*b* and 23*c*).

Answer 5 (N). Unquestionably there must be service fuses of proper size. This being so, the second question almost solves itself. The starting current is 150 per cent of the full-load current; the Code states that if the starting current is more than 125 per cent of the rating, there must be wires large enough to provide therefor, and then they must be properly fused. If this is done, and it must be, in such a way as to protect all wires leading to the motor from the service switch, it is not very material what you choose to put in on the starting panel or other mechanism. But I would prefer to plan so that if anything did go wrong during starting there would be fuses near at hand to safeguard things fully.

Answer 6 (B). This appears to be a hypothetical question in so far as (2) is concerned, not calling for an interpretation of the Code, but asking for an opinion as to what would be best under certain circumstances. Regarding (1) I would say that the Code requires service fuses independent of fuses or protective devices referred to in the question.

The statement that the wires between starter and motor must have a capacity 1.5 times the normal current rating of the motor is not the Code requirement, as the Code states: "Motor leads or branch circuits must be designed to carry a current at least 25 per cent greater than that for which the motor is rated. Where the wires under this rule would be overfused in order to provide for starting current, as in the case of many of the alternating-current motors, the wires must be of such size as to be properly protected by these larger fuses." In some cases, this would require a wire larger than the 25 per cent minimum mentioned in Code, or the 50 per cent mentioned in question.

Answer 7 (J). (1) Yes; service cutouts must always be provided, and they must be placed at the point of service entrance, as per rule.

(2) We require all three wires from the starting fuses to the starter and from the starter to the motor to be of a size that will be protected by the starting fuses. The smaller running fuses

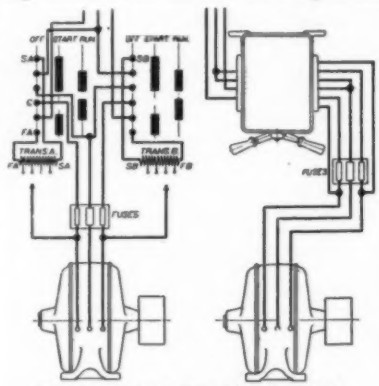


Diagram Illustrating Question 209.

are provided simply for a better protection of the motor, and bear no relation to the size of the wires. The wires from autostarter to motor will be somewhat overloaded during the process of starting, and during this time will not be fully protected by the starting fuses in the primary leads. But this condition, with a properly designed autostarter, can only exist during the few seconds when the apparatus is under direct manual control and observation in starting; during the all-day running period, the protection will be complete. We do not permit the overfusing of any wire, no matter how small the normal load may be.

Answer 8 (K). (1) We should certainly insist on the use of service fuses where this sort of motor starter was employed. Without these fuses one phase of the motor and two motor leads would be without any fuse protection whatever during starting.

(2) There should be no reason for making the middle wire larger than one of the outside conductors. We should insist on the use of three leads of same size, and should rule that the size of these must conform to the requirements of section eight of the Code.

Location of Branch Cutouts.

Question 210. In wiring for three or more ceiling outlets of 300 watts capacity each, through the center of a store building with service entrance at the rear, which would be more advisable: to run two or more circuits, or to run one line heavy enough to feed all outlets and then put a cutout at each outlet?

Answer 1 (J). It is advisable to run all circuits from a common distributing point where fuses can readily be gotten at when necessary and where cutouts, switches, etc., can be properly inclosed and fireproofed. The conditions surrounding cutouts scattered throughout the building as indicated, cannot be controlled as at a distribution center properly located. See fourth paragraph of "General Suggestions" in the Preface to the National Code.

Answer 2 (E). In answer to this question I would suggest that two or more circuits be installed and the cutouts thus centralized.

Answer 3 (B). This question appears to be a matter of good engineering rather than interpretation of the rules. Either method is permitted by the Code, and either method might be preferable according to local conditions.

Answer 4 (F). It would be advisable to install each outlet as a separate circuit feeding from a distributing center located at some accessible point on side wall, the cutouts being inclosed in an approved cabinet.

Answer 5 (H). It would depend upon the character of the wire installed. If the owner cared to have th wires exposed, as a heavy pair of mains running through the store, fusing for each outlet would be somewhat cheaper and quite as satisfactory. If the wiring were to be concealed in conduit or in molding, subcircuits supplying each 600 watts would be necessary.

Answer 6 (N). This question is not one having anything to do with Code interpretation, and the matter would seem to be purely a question of expediency in the special circumstances. I can readily imagine conditions where either method of wiring would be the only satisfactory solution.

Answer 7 (K). See fourth paragraph

of page 5 of the National Code, under "General Suggestions." While the running of a single circuit along the center of such a building and the taking off of taps or branches at convenient points, is a sort of construction frequently permitted, it is certainly a violation of the spirit of the Code, and is also open to criticism from the sandpoint of electrical construction standards. A very serious objection to such an arrangement is that the branch cutouts are generally made altogether too nearly inaccessible. We should rule that circuits for 660 watts, or less, must be run from a main distribution center and that all cutouts must be grouped there.

Among the Supply Men

The Relation of the Sales to the Credit Department.

At the meeting of the Electrical Credit Association of Chicago, November 21, one of the most interesting papers presented was that entitled "The Relation of the Sales to the Credit Department," by Thomas C. Ringgold. As sales manager of the Central Electric Company, Chicago, Mr. Ringgold has had a wide experience with regard to this subject in its aspect from the supply man's viewpoint. The paper follows:

"From what I have heard and read I am inclined to believe that in some directions there exists a lack of work-togetherness between the Sales and Credit Departments. I am proud to be able to say that my company does not suffer in this respect, so I do not speak with any personal feeling.

"A lack of co-ordination or harmony between the most important departments of any company is expensive and inexcusable. Where it exists it must be attributed solely to ignorance. The credit department is ignorant of buying, selling and what goes with it, and the sales department is ignorant of the financial phases and necessities of the business.

"Very few credit departments know anything of the difficulties and irritations that the man in the field contends with. They know nothing of the long hard struggle that is oftentimes required to get the customer's favor. They know nothing of the habits, customs and influences that govern the buyer. In other words, the amount of energy, brains and patience that must be disbursed in order to get the customer on the books. How can you credit men judge and analyze a buyer or his credit by the looks of his letter head or by what a $15 employee of a commercial agency has reported on him a year agone? How can you expect to sit at your desks and project yourselves over the miles or peer through the distance separating you from the customer and tell what is in the man's mind or his pocket, or know what it costs the sales department to get him and what it is worth to hold him? If you can do this successfully, then the Sales Department should be severely censured for not trying to sell goods on the same basis that you decide and collect on. What's the sense of having salesmen in the field if one can influence, attract and manage the customer just as well from a desk? A credit man, to be competent, decide wisely and equitably, must lift up his eyes from the cold figures and get into contact with the work in the field. Every fight or campaign that was ever directed by men seated in chairs, instead of saddles, has been lost. A couple of trips a year into the territory will do you a world of good mentally and physically, and qualify you to discharge your responsibilities in a way that will bring business to the house rather than drive it away.

"Remember—it is not the refusing of further credit that damages so much as the incessant dunning letters written by a stranger to a stranger in a mechanical tone, without a spark of life, vitality or human feeling. A dozen sales letters, a $3.00 catalog, scores of visits of a $3,000 to $5,000 a year salesman, and thousands of dollars' worth of profit can be, and with regrettable frequency are nullified by one tactless credit letter—and plus all this is the discouragement of the salesmen. I tell you men that it is more difficult to supply encouragement than anything else. We can buy merchandise for our shelves—we can employ credit men, too—but successful salesmen are born and must be educated and you cannot shoot encouragement into them with a gun any more successfully than some of our churches have tried to shoot religion into the heathen with a gun. I don't know of anything more expensive than a discouraged salesman (unless it is a discouraged customer), especially when the discouragement comes from his own house and is not inspired by good business sense. When a customer pays on the minute month in and month out, do you occasionally write him a warm, human letter of appreciation? When he comes across with a goodly sum in response to your appeal, do you thank him? Oh; yes—the office boy writes 'Thanks' across the face of his bill. Now look at the contrast—the sales department is continually writing customers words of appreciation for good orders, or some other courtesy, and it is just this contrast that helps to make the credit man so unpopular. They leave all the pretty stuff for the other fellow to offer, so the result is that some of them get just what they give—NOTHING.

"Now let us look at the other side. The sales department is sometimes or usually so ignorant of the financial part of the business that they don't know even the fundamental principles that must underlie every permanently successful institution. To them the credit man appears as an individual who tears down as fast as they build up. They are well aware that he don't know the customers or what it costs to get them, and they bitterly resent judgment being given by a judge who has read only a part of the evidence, never seen the defendant or heard his defense, or if he has been given a chance for a defense it has been put so that it creates a feeling akin to that inspired by a policeman when he pushes and pulls, and otherwise undeservedly abuses a citizen in advance of his being heard or convicted by the proper authority. 'Well,' says the credit man, 'why don't the salesman get a line on the financial standing of the unrated customer when he takes his first order?' I'll tell you why he don't:

"(1) He is working his head off to get the order, and he fears to offend by asking financial questions.

"(2) He hasn't time enough to spend with his trade to let alone making credit inquiries of others.

"(3) You don't pay much attention to his report anyway, but generally hold up the first order and disapprove the salesman's claims of good service while you write for references.

"(4) You are no friend of the salesman—why should he do your work for you?

"Don't you see, gentlemen, it's ignorance all the way through—ignorance of each other—ignorance of each other's responsibilities—ignorance of each other's

mind and the principles that govern and control. With two bands in the same parade playing different tunes, it is poor business trying to keep step with both, even the bandsmen failing.

"The REMEDY? Why, it's simple enough. Not less than twelve times a year, and oftener if possible, hold joint meetings of the heads and the subordinates of both departments, and don't forget the subordinates because they are the fellows that always write the fool letters; as they know even less about the territory and its customers than you do, they need the education more. Carefully explain what each has to contend with. Educate each so that they have a working knowledge of both—make every salesman know that he cannot afford to sell unwise risks or extend the credit period too liberally. Make every credit man and employee know why he cannot afford to be a mechanical, unfeeling automatom. Make him understand that he must visualize the man he is writing to and put a little bit of warmth into his letter.

"Get a knowledge of the work in the field, you credit men.

"Get a knowledge of the work in the office, you salesmen.

"Get close to each other—work for each other—one for all—and all for one.

"Lastly, my brethren, bring the power of your Association against the present system of the commercial agencies, which is far from being accurate or up-to-date, and is so created as to protect them, while giving you much less than you are entitled to in return for what you pay."

W. W. Low, president of the Electric Appliance Company, Chicago, Ill., returned last week from an extended southern trip and reports business in a very flourishing condition. Charles R. Churchill, general manager of the Electric Appliance Company of New Orleans, has started on his trip to South America, and W. G. Sterett, formerly of the Hobson Electric Company, has been made manager of the Electric Appliance Dallas office.

H. E. Monk, of W. R. Ostrander, on a trip through Baltimore recently, was very much pleased with the amount of business gotten in that city for this time of the year.

The Western Electric Company, with a branch at Third and Walnut Streets, Cincinnati, O., has leased an additional storeroom for its retail department on the west side of Main Street between Fourth and Fifth Avenues.

Public Service Commissions

CALIFORNIA.

A decision was rendered granting permission to the Ojai Power Company to issue $25,000 of stock, for the construction of an electric light plant in Nordhoff, Ventura County. The company was also granted a certificate of public convenience and necessity to exercise franchise rights.

The application of the Coalinga Water & Electric Power Company for an order authorizing the expenditure of funds secured from bond sales was dismissed upon the request of applicant.

MASSACHUSETTS.

The Central Massachusetts Electric Company has filed an appeal with the Massachusetts Gas and Electric Light Commission from the decision of the Selectmen of Palmer, Mass., granting the right to the Warren Power Company to enter that town. The same company appeals from the decision of the Selectmen of Enfield, Mass., allowing the Connecticut River Transmission Company to enter that town.

NEW JERSEY.

The Board of Public Utility Commissioners has issued in pamphlet form the uniform systems of accounts which have been prescribed for public-utility companies dealing in electric light, heat and power, street railways, gas and water supply. The new systems will go into effect on January 1, 1913.

NEW YORK.

The Public Service Commission for the First District has modified the orders issued by it last February requiring the New York Railways Company and the Third Avenue Railway Company to set aside each year a specified amount of money as an amortization fund to make up the difference between the value of the property and the securities issued by the companies in their respective plans of reorganization. In the case of the New York Railways Company, the amount ordered set aside for amortization was $108,000 each year plus four per cent upon all prior payments until the fund shall amount to $16,500,000. In the case of the Third Avenue Railway Company, the amount to be set aside was $180,000 plus four per cent upon all prior payments until the fund shall amount to $25,000,000. These amounts of $16,500,000 in the case of the New York Railways Company, and $25,000,000 in the case of the Third Avenue Railway Company were the sums respectively, the Commission held, by which the proposed security issues exceeded the value of the property. The orders just issued modified the previous orders by cancelling the requirement for the establishment of this amortization fund in the case of each company, on the ground that under the law, the Commission, while satisfied of the necessity for providing such amortization funds, was not warranted in ordering the companies to provide them. The modifying orders were issued after a rehearing held upon the application of the New York Railways Company, at which the company questioned the power of the Commission under the statutes to require the establishment of the amortization fund. Upon reconsideration, the Commission upheld the company's contention in this respect. The new orders make no further changes and the provisions of the orders issued in February as to the approval of the security issues provided in the plan of reorganization of each company, as well as the provisions for depreciation, are allowed to stand unchanged.

OHIO.

The Caxton Power Company, of Cleveland, O., has been authorized to issue capital stock to the value of $1,000 for the purpose of completing its legal corporate organization.

INTERSTATE COMMERCE COMMISSION.

The Commission in conference voted that it has jurisdiction over wireless messages from a commercial station in the United States to a ship at sea, whether a United States or a foreign ship; but that it has no jurisdiction over messages between two American ships at sea.

Legal Notes

MUST AN ELECTRIC COMPANY CARRY WIRES OTHER THAN ITS OWN ON ITS POLES?

By Maguire and Mooney.

As has been remarked frequently, a company supplying the public is in the nature of a public enterprise, and as such it may be regulated. But such regulations must at all times be reasonable. To compel a company to do that which is unreasonable would bring profit nor advantage to none, but nevertheless it is often rather difficult to determine what is reasonable and what is unreasonable. It is true that in looking back one may easily be distinguished from the other, but in looking into the immediate future it is difficult. Reasonableness is more often seen from results and thus it is sometimes hard to decide whether to enforce certain regulations or not; only their enforcement can be the true test.

To enumerate the methods and restrictions of municipalities in granting franchises is a difficult matter, but there are a few matters that arise frequently and are of common enough interest to consider. Each municipality attempts to regulate the companies seeking franchises until some very peculiar regulations arise. One of the most frequent regulations is the power to require public-service corporations to carry municipal wires on their poles. This is the same burden that is placed on the poles as if there was a pole charge. In the case of Sunset Telegraph & Telephone Company vs. City of Pasadena, 118 Pac., 796, two companies were operating systems in and about the city of Pasadena. Both companies had about 130,000 customers. The companies, while being permitted to, did not operate a telegraph business, only a very few messages ever being sent in that manner. In 1887 a 20-year franchise was granted to the company to erect poles and run telephone wires along the public streets. Certain supervision as to the location, construction and maintenance of the poles and wires was reserved. In February, 1908, an ordinance was passed making it unlawful to erect or maintain telegraph or telephone poles without a franchise and requiring that companies maintaining such shall pay 75 cents for each pole so maintained.

Some cities have inserted in franchises a provision requiring the public-service companies to carry upon their poles the wires of a municipal system or of other public-service companies. Such clauses are always enforceable. When not provided in the franchise, the right of a municipality to compel such performance by ordinance is questionable.

The company failed to apply for a renewal of its franchise and also failed to pay the charge imposed on each pole maintained. Accordingly the city proceeded to remove the poles and wires from the streets. Whereupon the company obtained a temporary injunction restraining such action.

The company claimed that it was doing an interstate business and thus should have been permitted to occupy the streets without the city's permission. The court, on this point, held that the mere fact that a company is engaged in interstate commerce does not give it the right to occupy portions of public highways of a state without proper authority or permission. The company contended that the ordinance making a charge of 75 cents a pole was unconstitutional because of discrimination. It was held that the ordinance was optional—the company could secure a franchise and would not need to pay the pole charges, or it could pay the pole charges and not obtain a franchise.

This case shows the methods of forcing companies to pay pole charges, but other cities release the pole charges to add only another burden. The most frequent, as has been stated, is the requirement forcing public-service companies to carry wires other than their own. Unreasonableness is something that is always charged by both sides and it is often a difficult question to determine. Municipalities like to obtain advantages over public-service corporations and this is one of those weapons that is annoying. To force a public-service corporation to carry the wires of a fire-alarm system or for some other purpose may be a perfectly profitable arrangement for the municipality, yet it is troublesome to the company. There is a greater obligation resting upon the electric company than that of merely carrying the wires. Various difficulties arise when the poles may have to be removed, or when the company desires to remove its system in a certain section, or change from poles to conduits. Propositions of this kind have not yet arisen, but they are necessary for consideration when such franchises are proposed. The great difficulty is the danger to those who work on the other system, and the resulting cost to the electric company.

In the case of Finch vs. City of Ottawa, 190 Fed. Rep., 299, the city of Ottawa, Kans., owned and operated the electric light plant. Finch was employed as a telephone lineman on the telephone system in Ottawa. In an alley in that city the telephone company ran a series of wires for telephone purposes and the city ran another and parallel series for lighting purposes. The wires of the two systems were about three feet apart. All these wires passed through the branches of a tree which protruded in the alley. A storm broke one of the telephone wires and Finch was sent to repair it. He picked up the broken end, but felt no shock when so handling it. When he started to pull the slack out of the wire he received a severe shock. The insulation on the city's wires was badly worn all along at this point. The court held that as the city was conveying a deadly electric current through the wires it was its duty to exercise reasonable care, commensurate with the dangers incident to the conveying of such current, to prevent injury to persons who had proper business at that point. This is an example of one difficulty that electric companies would have to overcome in permitting other systems upon their wires. Even if the telephone lineman had picked up a wire that he could see had no insulation upon it he might be able to recover even then, because as he was working on wires that were not dangerous he might not know the danger in the other wires.

In some cases involving ordinances whereby municipalities have required public-service corporations to carry municipal wires on their poles, the corporations seem to have accepted the condition without question, and the power of the municipalities to impose

such a condition seems to be assumed. Accordingly, a few companies, finding this to be onerous after working under it for some time, attempted to refute the power of the city to require it, but the courts, without considering the matter, held that when the franchise was accepted it made a binding contract and the electric company could not later repudiate part of it.

The best case on this point is Postal Telegraph-Cable Company vs. Chicopee, 207 Mass., 341. This was a suit by the company to enjoin the city of Chicopee from maintaining certain electric wires upon its telegraph poles. The city of Chicopee had passed an ordinance which provided that the mayor and aldermen should have the exclusive power to license the erection and maintenance of telephone and other lines of electric wires within the city and that any license granted pursuant to the ordinance should be subject to the rights of the city, free of charge, to place its fire-alarm, telegraph or other electric wires upon the poles or through the conduit so licensed to be maintained, and the right of the city to license the location of lines by any other person or corporation upon said poles and through said conduit, upon payment being made of a reasonable compensation, to be determined by the parties, or, if they failed to agree, to be determined by the mayor. There was also a requirement that all parties licensed to erect poles and fixtures and to maintain electric wires should give to the city an agreement in writing to save it harmless from all claims for damages, costs, etc., for or on account of the erection, maintenance or use of such poles, fixtures or wires. The court held that the right of the city to pass such an ordinance was unquestioned and dismissed the company's suit. It was held that the city was attempting to make careful provision for the protection of the public, and accordingly had a right to regulate in this respect.

Careful regulation of the erection and maintenance of poles and wires in a city's streets is very necessary. As cities grow, the use of electricity for various purposes becomes more pronounced and to satisfy this more wires must be used, more poles are needed, and in closely built streets it is urgent to eliminate as many inconvenient and unnecessary wires, poles and other obstructions as is possible. Some cities solve this by requiring wires to be placed in conduits, but even then there may be a multiplicity of conduits, and the city may regulate them. By the running of lines of wire upon different sets of poles in a crowded city the difficulty of extinguishing fire and preventing a conflagration is often increased, as well as the danger and inconvenience in using the streets in an ordinary way, and also the unsightliness of numerous poles and wires.

However, a feature of this that needs a great deal of attention is the inductive feature. Frequently electric lighting is done with an alternating current of high tension, and the proximity of wires carrying such a current may, by the inductive effect, interfere with the efficient operation of telephone lines. This inductive feature may or may not be of importance, depending for the most part on the wires, their location, effective transposition, and on other matters familiar to electrical men.

It has also been held in certain states that, where the state gives municipalities the general power to designate the streets in which the poles of a company shall be placed, subject to such proper regulations and restrictions as may be deemed to the best interests of the town, the municipality cannot force the company to permit its poles to be used to carry police or fire wires.

Thus it is a question of some import as to whether an electric company operating in large centers can afford to permit other systems on its poles. It is a question that must be considered by each company. Some may find such an arrangement to be satisfactory; others might find it a very bad arrangement. Under the powers the municipality can require all wires to be carried on one set of poles. This is of importance to companies that operate high-tension lines across country. And the companies that use conduit to convey their wires also have to consider this. They may have conduit big enough to carry all the wires they use with a sufficient space left for such wires as an increase in business might require, yet the city might require them to carry the police or fire wires in the conduit and in this way completely fill up the surplus space. In what position would the company be when the increase in business and the necessity for additional wires came? It could not place them in the conduit, and it could not ask the city to take out its wires.

Motion-Picture-Film Patent.

The Court of Appeals of the District of Columbia handed down a decision on December 2 in the patent suit instituted by the Motion Picture Patents Company against the Chicago Film Exchange. This involved the Edison patents on moving-picture films, which the court found to be invalid, so far as Claim 2 of reissue No. 12,192 is concerned. This claim covered "an unbroken, transparent or translucent tape-like photographic film provided with perforated edges and having thereon uniform, sharply defined, equidistant photographs of successive positions of an object in motion." It is claimed that the effect of this decision will be to release motion pictures from patent rights.

Swiss Hydroelectric Power Developments.

In a recent report from an American consular agent at Zurich, Switzerland, are given many interesting data respecting the remarkable development of hydroelectric power in that country. Space permits giving only a few of these facts here. The first plant along modern lines was placed in operation in 1887. The absence of coal and the success of the early electrical undertakings stimulated further development and since 1900 this has been going on at a rapid rate. In 1911 there were 783 electric power plants in operation in Switzerland that furnished central-station service; in addition there were many small isolated plants not included in these remarks. Of the 783 plants referred to, 473 belonged to corporations that did not generate electrical energy, but merely bought from larger plants and resold to retail customers. Of the 310 generating stations, 233 were wholly or nearly wholly hydroelectric plants and only 77 were steam or gas-driven plants, all of these being small. Several of the hydroelectric stations have steam auxiliaries, however, to provide for low-flow periods in rivers fed from glacial sources. In the fiscal year 1910-1911, 108 electric power plants were completed and placed in operation.

On account of the importance and great value of cheap electric power to the Swiss people, the Swiss Federal Government has imposed many restrictions to its exportation to neighboring countries. The Government holds no monopoly, however, over its rivers and streams for power purposes. It has been estimated that the Swiss waters are capable of developing about 2,000,000 horsepower, of which a little over one-quarter has been put in active service. The total length of overhead transmission lines was over 4,600 miles last year.

Electrification Progressing in England.

Another steam railroad terminating in London has decided to adopt electrification for its suburban traffic. An announcement of this decision has been made by the London & Southwestern Railway.

The action of the London, Brighton & South Coast Railway in electrifying its suburban lines has been remarkably successful in winning back traffic which had previously been lost to the electric railways in the same territory.

LETTER TO THE EDITOR.

Co-operation.

To the Editor:

Ever moving along co-operative lines, for more than a year I have had in mind the formation of a society which would carry out the direct principles of Jovianism, namely, co-operation. For the last six or seven years I have been holding meetings of the inspectors of this department[1] every two weeks, being on the second and fourth Thursdays of the month. The meetings are called for 7:30 and adjourn about 10:30 p. m. The object of these meetings is to so familiarize the inspectors with the Code that in ruling on jobs there is small liability of an inspector in one section of the city ruling differently from an inspector in another section of the city.

Three months ago I requested the inspectors and the district managers of the public-service corporation in this city, which is the Philadelphia Electric Company, to attend our meetings, also the municipal inspectors and the electrical contractors. The contractors were also asked to invite their superintendents and foremen, or any of their mechanics whom they thought would be interested in a meeting whose object was co-operation. At these meetings we talked over the Code and regulations, ask for suggestions, how the underwriters' inspectors can best cooperate with the interests and how various branches of the electrical industry can co-operate with a view of building up the electrical industry in our territory. These meetings have proved most interesting and instructive.

These meetings were called in the offices of the Fire Underwriters' Association. At the last meeting there were 75 present. A number were unable to attend the meeting, as the room was not large enough, the seating of 75 persons being the capacity of our board room. The Philadelphia Electric Company, through President Joseph B. McCall, very kindly advised us that it would give us the use of its library on the sixth floor of its building at Tenth and Chestnut Streets for future meetings.

It is my belief that in bringing all the electrical interests together and talking over matters once a month, explaining blanks and forms used by the inspection department, how they should be properly filled out and the necessity of properly following instructions in order to facilitate not only office work, but the ultimate result, namely, of having current introduced in the building, also the explanation of blanks made for the application of current from public-service corporation, and office and inspection practices, the methods of making electrical installations, etc., will be most beneficial to all at interest.

A question box is provided and questions between meetings are taken up by a special committee and answered to their satisfaction, and are read at the subsequent meeting. Sections of the National Electrical Code are read at the meeting and their meaning explained, as for instance, a contractor or a mechanic will ask under Rule 1-*b*, "What do you mean by hazardous process?" Then such processes are explained, as for instance, he is told that in saw mills, candy factories, flour mills, or in fact in any establishment where vegetable dust or finely divided particles are floating in the air, such processes are defined as "extra hazardous," also in certain portions of oilcloth works, tanneries, etc. Such a paragraph and explanation may take up the greater part of an evening, but the time is surely well spent and I know that you will agree with me that such work in five years' time will show a marked improvement in methods of installation, because a mechanic will not only understand the requirements of the Code as to installation, but he will understand the "why" of the rule, the ultimate result being high-grade efficiency on the part of the mechanic as a result of proper training.

We have a Device Committee to examine and explain all new devices pertaining to our work and get as much data as possible relating to these devices.

A Membership and Attendance Committee, whose duties are obvious, with the addition that they welcome and introduce the members to each other and promote good fellowship.

A Papers and Meetings Committee to arrange for papers, meetings and subjects for discussion.

A Library and Reference Committee to look up all press articles, good books, references, etc., pertaining to our work.

A Tabulated Data Committee to tabulate such data and put same in a handy and concise form for use, such as greatest number of wires in a conduit of a given size, motor leads, etc. It would seem to me that this committee would fill a long felt want, as there seems to be a difference of opinion about some of the most common things in our work.

A Relations Committee to take up with other societies, associations, etc., such practices as we may deem advantageous to the industry.

We think we have started something worth while. We call ourselves the Electrical Conference. If you think well of the scheme, will you be good enough to make mention of the proposition in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, in order that the attention of our brothers in the electrical industry may again be called to progressive Philadelphia and the new scheme for electrical development which we have to offer..

WASHINGTON DEVEREUX,

Philadelphia, Pa., December 9, 1912.

[1] Electrical Department Philadelphia Fire Underwriters' Association.

Electricity in the Coast Artillery.

The use of electricity in the Coast Artillery of the United States includes power plants, telegraph, control of firing of batteries of guns, firing of mines, operation of searchlights, etc. A training school for electricians is maintained. The following extracts are taken from the report of E. M. Weaver brigadier-general, chief of Coast Artillery, to the chief of staff, Leonard Wood, major general. The report has been approved by the Secretary of War.

It is believed that the necessity for central fortification plants, as recommended by the National Coast Defense Board, no longer exists, except in some special cases—for example, where power from outside commercial sources cannot be obtained.

It is believed that in future the adopted policy should be:

(1) To provide all batteries requiring power for fortification purposes (or, in certain cases, groups of batteries) and in general all searchlights, with suitable local direct-connected direct-current generating sets, preferably oil or gasoline-engine-driven; these local plants to be so interconnected and provided with suitable reserve sets as to insure continuity and flexibility in service.

(2) In general, in time of peace, to purchase the power for the post lighting system and for other similar post purposes, when it is in the interest of economy to do so, from commercial sources, and in such case to separate the post lighting system from the fortification system.

(3) To install a central plant in case it is impracticable advantageously to purchase power for the post service, and in case the fortification system is insufficient for that purpose, such plant to constitute a reserve for fortification purposes.

(4) To employ direct current for the post service systems in all cases except where transmission conditions are such as to render the use of direct current decidedly uneconomical.

(5) The Quartermaster Corps to install a suitable reserve plant in case the fortification system does not provide such a reserve in all cases where power is purchased from a commercial source, the object of this arrangement being to provide for the actual necessities of the post in time of hos-

tilities in case the source of commercial power be interrupted.

(6) In general to provide, whenever practicable and advantageous, for interchangeability between the post and fortification power systems, including the introduction of suitable converters whenever these are necessary.

(7) All power plants to be operated under the supervision of the Coast Artillery authorities, employing, whenever practicable, Coast Artillery enlisted personnel for that purpose, the object of this being to insure co-ordination and to prevent a division of responsibility in case of emergency.

It is believed that the system above outlined will provide for maximum reliability for fortification power in time of war and for maximum economy in time of peace.

With reference to submarine mines, searchlights, and power plants, the situation is as follows:

Only seven of our harbors have received a standard installation for fire control. The standard installation for Fort Monroe, Va., is now under way. The other districts are working under temporary systems which, while in general satisfactory for instruction purposes, are expensive to maintain and might be destroyed even in the early stages of an engagement.

Recent war has demonstrated the value of submarine mines as an element of harbor defense. If a harbor be defended by an efficient system of mines provided with the requisite guns and searchlights for their protection against countermining, sweeping or other methods of removing them, it is not believed that any enemy, however enterprising, will ever attempt to force an entrance into a harbor with large ships. Submarine mines, alone of all the elements of the defenses, are practically unaffected in efficiency by darkness, fog, or other adverse weather conditions. After they are once planted, they are thereafter always immediately available and effective. It is a matter of satisfaction that severe tests have proved our system of mines to be exceptionally efficient as a war weapon. The necessity for completing at once the submarine-mine equipment has been frequently urged in past reports of my predecessors. In the annual report of the chief of Coast Artillery for 1910 it was stated:

"We cannot afford to wait for war before completing our mine defense, but must be prepared beforehand; for unless we are thus prepared, no amount of money made available at the outbreak of war could procure mine material in time to be of service in mine defense against an active, enterprising enemy. Essential parts of this material, such as cables, mine cases, and electrical apparatus, cannot be bought in open market, but must be manufactured to order, and after having been ordered it requires months to fill the orders. If confronted suddenly by war, only such material as is on hand can be utilized for immediate mine defense, and if any essential part of the mine system is lacking, the whole mine defense must fail. The complete mine equipment of every harbor to be mined should be kept on hand ready to be planted, and it should be made possible to mine effectively every harbor within 48 hours."

With the exception of the cable, the supply of the essential parts referred to above has been practically completed for all of the existing home ports, except for the artillery districts of Galveston and New London. The need of making immediate provisions for the additional cable absolutely required to enable the mines, which are already provided, and for which all the principal accessories are also provided, to be planted at all home ports in case of emergency is an urgent one.

For the fiscal year 1914 the estimates for submarine mines for home ports will amount to $161,084 and will provide for some of the material necessary for the equipment of the artillery district of New London and for one-half the total additional cable necessary for the service of mines already on hand.

Searchlights.

It is estimated that it will require $2,536,600 to complete the searchlight equipment for the United States forts.

The estimates recommended for the fiscal year 1914 will include $250,000 under this item, to be expended in the artillery districts of Southern New York and Boston. It is expected that this sum will complete so much of the searchlight installation in these districts as is practicable in time of peace. Twenty-three 60-inch lights are required. Fourteen have been purchased. Of these four have been installed tentatively.

These districts are provided with complete modern armament and the most modern fire-control installations. It is essential that the armament and fire-control equipment shall be supplemented by a permanent searchlight equipment if the fortifications are to be effective in night action.

It should be kept in mind that searchlights of the power necessary for coast-defense purposes cannot be obtained in open market on the outbreak of war, or when war is imminent. They are a special article of manufacture and require normally approximately one year to supply. The mirrors cannot be obtained in the United States.

The appropriation for searchlights for the fiscal year 1913 was only $25,000. Over half of the artillery districts in the United States are now provided with less than one-third of the searchlights required for their proper service. Moreover, in a few years it will become necessary to begin the replacement of worn-out and obsolete lights; many of those first purchased are now practically obsolete, and some nearly unserviceable through wear and tear incident to use.

Unless appropriations be increased for searchlights, the efficiency of the coast fortifications for night action will be destroyed in all localities where effective lights are lacking.

Enlisted Men.

This department is meeting the needs of the service in a very satisfactory manner. Those enlisted men who complete successfully the courses are eligible for appointment to certain noncommissioned staff grades of the Coast Artillery Corps and in the Coast Artillery School Detachment.

Four courses are pursued:

(1) Electrical course, to prepare men for appointment as electrician sergeants, second class.

(2) Mechanical course, to prepare men for appointment as firemen.

(3) Artillery course, to prepare men for appointment as master gunners.

(4) Radiotelegraphy course, to give selected enlisted men instruction in radiotelegraphy.

The work covered in each of these courses is partly theoretical, but mainly practical. An enlisted man who completes successfully a course can take up immediately at a post the work for which he has qualified.

During the past year there were 17 students in the artillery course, 29 in the electrical course, 11 in the mechanical course and 9 in the radiotelegraphy course.

The work of most of these students was satisfactory; the few who were unable to keep up with their courses were relieved from the school.

The course in radiotelegraphy was inaugurated in January, 1912. Both electrician sergeants and privates receive instruction in the latest Signal Corps type of radio set. Electrician sergeants receive special instruction in the installation and upkeep of the plant, while the privates are trained as operators.

The power plant at Fort Monroe is operated entirely by enlisted men of the Coast Artillery Corps under the supervision of the head of this department of the school. It is used for instruction purposes by both the officers' and the enlisted men's divisions. The results obtained in the operation of this plant have been very satisfactory, an average daily power and lighting output of 1,200 kilowatt-hours for the 12 months ending February 29, 1912, having been produced at a cost per kil-

owatt-hour at the switchboard of 3.38 cents, including all supplies, repairs, labor and depreciation, or 1.19 cents, excluding labor and depreciation costs. It is estimated that the installation of this plant and its present use for post lighting, pumping, fortification, school, and heating purposes, has resulted in a decrease in the total annual maintenance cost of the school and post of Fort Monroe of approximately $25,000 or, making allowance for labor of all enlisted personnel involved and for depreciation cost of plant, in an annual net commercial saving of over $13,000. It is indicative of the high opinion held of this plant in commercial circles that some of the most prominent manufacturers of engineering apparatus in the United States have cited it as exemplifying in a noteworthy manner the efficiency that can be obtained with isolated plants of comparatively small capacity by the application of the best methods of modern engineering practice.

Among the technical non-commissioned staff officers of the Coast Artillery Corps called "enlisted specialists" there are three distinct classes—the electrical, whose duties are, briefly, to operate and maintain the electrical installation, searchlights, etc.; the mechanical, whose duties are, briefly, to operate and maintain power plants, machine shops, etc.; the artillery, whose duties are, briefly, to maintain in thoroughly efficient condition the armament proper—guns, carriages, range and position finders, plotting boards, and all accessory devices connected directly with accurate and rapid firing of the armament.

These classes are equally important, and similar grades in each class should be given equal pay and allowances; the opportunity for advancement should be equal in all three classes, and promotion to any grade in any class should be limited to those holding the next lower grade in that class.

It is recommended that the classes be arranged as shown in the following table. All of the enlisted specialists should be entitled to quarters.

In order to prevent the reduction of pay of any man now in the service, it is recommended that engineers and electrician sergeants, second class, now in the service, be continued at their present rate of pay as long as they hold their present grades, and that the master gunners now in the service be designated gunner sergeants, senior grade.

Great Copper Reserve.

The copper industry in the United States has shown a notable growth, according to the United States Geological Survey. In 1845, when important production of copper in this country practically began, the output was but 221,000 pounds, but it increased 100 per cent the following year and gained by rapid strides until 1850, when the production was 1,456,000 pounds. In 1870 it was 28,224,000 pounds; in 1890 it was 259,763,092 pounds; in 1900 it had increased to 606,117,166 pounds; in 1909 it passed the billion mark, with 1,092,951,624 pounds; and in 1911 it exceeded all previous records with a production of 1,097,232,749 pounds. The world's production in 1911 was 1,958,201,285 pounds, of which 56 per cent was the output of the United States.

It is noteworthy that, unlike areas producing most other metals, not one of the leading copper districts of the United States, several of which have been active producers for a period of 30 years or more, has been worked out or showed a marked decrease in its ability to produce copper. Twelve districts situated in eight states have each contributed over 100,000,000 pounds to the copper output of the country, or a total of 94 per cent of the whole output of the United States since 1845. Four of these districts are in Arizona, two in California, and one each in Montana, Michigan, Nevada, New Mexico, Tennessee, and Utah. Two districts stand out prominently, the Butte district, Montana, which has contributed over one-third of the output of the country, and the Lake Superior district, Michigan, with a production of a little less than one-third of the total output.

Grade.	Now Authorized. No.	Pay Per Month.	Total Yearly Pay.	Recommended. No.	Pay Per Month.	Total Yearly Pay.	Dec.	Inc.
Electrical specialists:								
Master electrician	26	$75	$23,400	26	$75	$23,400	.....	.....
Electrician sergeant, senior grade (now called first class)	74	45	39,960	74	45	39,960	.....	.....
Electrician sergeant, junior grade (now called second class)	74	36	31,968	100	30	36,000	.....	$4,032
Mechanical specialists:								
Master engineer	..	..	.....	26	75	23,400	.....	23,400
Engineer	60	65	46,800	74	45	39,960	$6,840	.....
Fireman	60	30	21,600	100	30	36,000	.....	14,400
Artillery specialists:								
Master gunner	42	40	20,160	26	75	23,400	.....	3,240
Gunner sergeant, sen grade	..	..	.....	74	45	39,960	.....	39,960
Gunner sergeant, jun. grade	..	..	.....	100	30	36,000	.....	36,000
Total	336	..	183,888	600	..	298,080	6,840	121,032
								6,840
Net increase								114,192

Industrial Lighting with Incandescent Lamps.

A meeting of the Chicago Section of the Illuminating Engineering Society was held in the rooms of the Western Society of Engineers, Chicago, Ill., on December 11. In opening the meeting, Chairman F. A. Vaughn called attention to the arrangements being made for holding the February meeting of the Section jointly with a number of engineering societies in Milwaukee, Wis.

A paper entitled "Industrial Lighting," by Ward Harrison, of the engineering department, National Electric Lamp Association, was presented. The author showed in the opening of his paper that the object of providing illumination in shops and factories was to permit quick and accurate work being done and to promote the safety and general welfare of the employees. Among the more important requirements for this class of lighting are that it must be of sufficient intensity and yet not excessive; it must be free from glare and be provided at low operating and maintenance cost.

In order to get sufficient illumination the light should come from many directions, so as to illuminate not only the horizontal surfaces but also the sides of the object being worked upon. By using a fairly large number of light-sources, such as incandescent lamps, instead of a small number of more powerful units, the failure of any single unit or its temporary cutting off by some obstruction does not greatly affect the illumination result obtained but also gives much greater uniformity of illumination. To secure the latter the spacing distance between units should not, if possible, be greater than 1.6 times the height of the unit above the working plane; at any rate it should not exceed twice this height. Steady lighting is imperative. Therefore it is highly desirable to separate the lighting and power circuits. It is also well to be careful about what illuminants are placed upon 25-cycle circuits; lamps taking less than one-half ampere are very likely to produce noticeable flicker at such low frequencies.

In determining the quantity of light, or rather its intensity, it must be remembered that all improvements in a factory are made with the idea of reducing the cost of production. The actual foot-candle intensity supplied depends a great deal upon local conditions, such as the color of the work in hand and the necessity of being able to see fine details therein; it also depends upon the nature of the department. The minimum illumination for safety is about one-quarter foot-candle and the maximum should not be over 40 to 50 foot-candles, because any increase in intensity above this produces relatively small increase in the ability to see. Probably in 90 per cent of installations the intensity varies be-

tween one and six foot-candles. Various tables of recommended intensities for different classes of work have been published. In using them great care must be exercised to take account of special conditions likely to be met with. The tendency in recent years is undoubtedly toward increasing intensity of illumination. This is largely because of the more efficient units available and also because it is becoming more generally known that the cost of good illumination is but a very small percentage of the total labor costs in a plant. In many places this cost is only one-half of one per cent of the total wage item.

Mr. Harrison discussed the causes and effects of glare. This is in all cases highly undesirable and must be prevented or minimized as much as possible. One of the chief sources of glare is to have lamps directly in the field of vision. This always counteracts the ability to see properly. Uniformity of illumination is desirable as a means of decreasing glare from excessive contrasts. The light-sources should be so placed and screened as to prevent giving specular reflection from bright surfaces on machinery or objects worked upon. It is highly desirable to provide a general illumination throughout the shop. This is both in order to promote safety and also for the sake of improving visual efficiency. It is interesting to note that a well illuminated workroom has a most wholesome psychological effect upon the employees. In making comparisons between various installations probably too much stress has been given to illuminometer tests. These are, of course, highly valuable, but should not be used as the sole criteria of the effectiveness of the illumination.

Taking up the subject of incandescent lamps, Mr. Harrison dwelt at length on the performance of tungsten units. The statement commonly made that the life of tungsten lamps is affected by having them inclosed in close-fitting reflectors or diffusing globes is not warranted by the actual facts, because repeated tests in which tungsten lamps were operated at even oven temperatures showed no appreciable effect upon the life. During their rated life the average horizontal candlepower is about 93.5 per cent of the initial and the average wattage is 98 per cent of initial. Mr. Harrison does not recommend the operation of series lamps in clusters on multiple circuits. Formerly the series tungsten lamps, being more rugged in construction, were found more satisfactory than multiple lamps in many places subject to jar or vibration. Since the introduction of the drawn-wire lamp, multiple lamps for standard circuits are preferable. They permit much greater flexibility and avoid complication of wiring.

Mr. Harrison took up at length a discussion of reflectors adapted to industrial illumination. Practically every type of reflector can be used for this purpose, but it has generally been considered that the use of glass reflectors is rather restricted in this line. Enameled and aluminized steel reflectors are most largely used. In many places, however, glass reflectors, whether they be of the mirrored, prismatic or transluscent types, can be very well employed. The last type of glass reflector, on account of its relatively low efficiency, has probably the smallest field of usefulness in workshop illumination. Prismatic glassware has been employed to a considerable extent in relatively clean shops, and where the liability of breakage was not very great. It has the advantage that it permits some light to fall upon the walls and ceiling of the room, thereby making the entire aspect more cheerful than is the case where an opaque body is used for the reflector. In many cases the use of glass reflectors has been the means of teaching workmen to be more careful. The use of mirrored-glass reflectors, although employed heretofore only to a very limited extent, seems to have considerable possibilities.

The question of cleaning lamps and reflectors is a very important one in all shop lighting. It is, of course, well known that dust and accumulations of dirt have a very material influence in reducing the efficiency of the lighting system. Since the cost of regular and frequent cleaning is relatively low compared with the ultimate cost of neglecting this, it is self-evident that frequent cleaning should be insisted upon in every installation. In some tests to determine the effect of dust on various types of reflectors it was shown that in a commercial installation, which was allowed to have its lighting units accumulate dust for 40 weeks, at the end of that time the loss in illumination efficiency was 20 per cent for the enameled-steel reflectors, 32 per cent for prismatic-glass reflectors and 37 per cent for transluscent-glass reflectors. Aluminized steel probably has a slightly greater loss from dust and dirt than enameled steel. The influence of accumulations of dust and dirt is quite marked in changing the candlepower-distribution curve of different types of reflectors; in the case of enameled-steel reflectors the change of distribution is relatively small, whereas in those reflectors in which direct reflection is more prominent the effect of dust produces a very marked change in the light distribution. It is not generally known that in enameled-steel reflectors by far the greater part of reflection is of a diffuse character. This has an important influence upon the character of the distribution that can be obtained from various shapes. In such reflector materials as make more complete use of direct reflection it is easier to produce any desired distribution. Compared with aluminized reflectors, enameled steel is somewhat more expensive, but in 90 per cent of cases is much better because it can be kept clean more easily.

Where acid fumes or other corrosive gases are given off, the enameled or glass reflectors are the only ones that can be properly used. In order to protect the otherwise exposed metal parts of lamp base, socket and reflector in acid rooms a good plan has been to place an asbestos ring about the lamp base; then upon screwing the lamp into the socket this ring fits closely against the bulb and the enameled surface of the reflector, thus affording complete protection. Reflectors are now almost invariably one-piece units. If steel reflectors have the same diameter and height, they give practically the same distribution results regardless of their actual shape. The color of the reflecting surface is very important in its influence upon the resulting efficiency. The presence of slight gray particles in an otherwise white surface lowers the efficiency very materially. A tinge of yellow or bluish has the same effect.

Mr. Harrison concluded his paper by showing slides of and describing several installations employing tungsten lamps. In one of these an open-hearth-furnace room was found to be very well illuminated by means of tungsten units equipped with angle reflectors and mounted on the wall opposite to the furnaces; as compared with the use of flaming-arc lamps that were hung over the traveling crane, the results were found to be superior.

The discussion of this paper was prolonged and consisted largely of commercialized and acrimonious remarks by several speakers representing rival reflector interests. Among those who participated were F. A. Vaughn, T. H. Aldrich, H. B. Wheeler, J. H. Warder, E. B. Gray, J. W. Foster, S. E. Church, A. L. Eustice and Mr. Harrison.

German Competition for Miners' Electric Safety Lamps.

According to *Electrical Engineering*, a prize of $6,250 for the best electric lamp provided with a reliable fire-damp indicator is being offered for competition in Germany by the Verein für die Bergbaulichen Interessen im Oberbergamtsbezirk Dortmund. The lamp is to be capable of giving a light of one Hefner candlepower after burning for 12 hours, must be safe in the presence of fire-damp even if damaged. Three lamps with descriptions (in German), drawings, etc., in triplicate, must be submitted to the Verein, at Essen-Ruhr, before October 1, 1913. The judges will be a committee representing the Government, the Westphalian Miners' Association, and the Dortmund Mine Owners' Association.

TESTS OF HIGH-TENSION INSULATORS.

Monthly Meeting of American Institute of Electrical Engineers.

The 278th meeting of the American Institute of Electrical Engineers was held at the Engineering Societies' Building, New York City, on Friday evening, December 13. President Ralph D. Mershon called the meeting to order. A paper entitled "High-Frequency Tests of Line Insulators," by L. E. Imlay and Percy H. Thomas, was presented by the latter. Mr. Thomas, as chairman of the High-Tension Transmission Committee, occupied the chair after presenting his paper. A paper by P. W. Sothman entitled "Comparative Tests on High-Tension Suspension Insulators" was, in the absence of the author, abstracted by John A. Brundige.

Tests of Line Insulators.

The object of this paper is to present interesting and suggestive high-frequency insulator tests made by the authors. Insulators were intended for a 38,000-volt line in connection with an existing line of 22,000 volts. The insulators on the latter are made of electrose with an umbrella petticoat about 12 inches in diameter and a second petticoat about 6 inches in diameter. They occasionally puncture through the head from lightning. They are mounted on grounded steel pins. This failure was surprising, since they had never punctured in testing, but would flash over when wet at about 90,000 volts, 25 cycles. Apparatus was therefore arranged to test at ordinary frequency and also at very high frequency by the use of an oscillatory discharge. A transformer of 500 kilowatts at 750,000 volts was used, one side of transformer and apparatus being grounded. The results of tests on the old insulators and upon a variety of new electrose and porcelain insulators are tabulated. The tests showed that several forms of insulators which failed by flashing over upon a low-frequency test would be punctured by the high-frequency test. The voltage in the latter frequently exceeded 300,000 volts. Electrose and porcelain did not differ in their behavior in this respect. Both petticoats were sawed off of one insulator, which then showed no failure under high frequency at 340,000 volts in over 150 trials. It is not believed that the effect was due to heating, as in that case cutting off petticoats would not increase the resisting power. In most cases a large number of applications at high frequency was necessary before puncture took place. A significant point is that no insulator failed on high frequency on the very first shock. An estimate of the frequency of the oscillatory circuit was 1,000,000 cycles per second. A theoretical discussion is given as to the reason for the observed effects and some tests were made with special arrangements in support of this theory. The tests show that it is desirable to include tests at high frequency in the practical work of testing insulators, at least to determine design. Such tests require large capacity and high voltage and the necessary frequency, voltage and electrostatic capacity are unknown. Tests are therefore difficult to make properly. The design of insulators to resist high-frequency discharges should include the wide separation of conducting parts from the pin and as great uniformity of electrostatic field between them as possible. Wide and thin petticoats add little to the strength. The authors decided to use wooden pins.

Tests of Suspension Insulators.

These tests were carried out to determine the insulator most suitable for a 110,000-volt line. Insulators were tested one at a time and also in parallel. The apparatus consisted of two 50-kilowatt, 150,000-volt transformers in series. Electrical tests were made dry, wet and under oil, and a mechanical test for strength was also made. The voltage was controlled by a water rheostat in the low-tension circuit. Voltage was measured by a voltmeter previously calibrated with a spark gap. The voltmeter was connected to the low-tension side of an instrument transformer connected to the primary of the test transformer. A photographic record was made showing the discharge over the insulators. Tabulated results for six types of insulator are given. In most cases the discharge was started by a sharp corner or point of metal fitting by means of which the sections were held together. While the link feature is advantageous from a mechanical viewpoint, it creates unfavorable stresses in the air between the disks. The diameter of the pin, together with the voltage it assumes, remains the determining factor for the highest stress of the porcelain within the cap. For this reason no advantage is gained by the use of a two-piece insulator. It is advisable to have the metal parts of insulators as symmetrical as possible, presenting a smooth and even surface without projections. This suggested the ball-and-socket type of connection. Another unfavorable feature of a two-piece insulator is the impossibility of equalizing the stress in the two pieces under all conditions. The use of a pin cemented into a porcelain shell looks, at first, doubtful, but has given no cause for complaint, while the link feature is a failure electrically. An European type of insulator met all the electrical requirements, but not the mechanical tests. The latter point could be covered by modifications of design. This type was not ordered, however, on account of the necessity for prompt delivery. Of the others, two failed to meet the electrical requirements, one involved a faulty design and another met the electrical but not the mechanical tests. The latter with modifications was adopted for use.

None of the types recommended by the manufacturers met the requirements of a strain insulator for the wet test. The author considers the problem of insulating high-tension transmission on lines as far from being solved, but much valuable experience has been gained. The various points necessary to be considered in designing and testing the insulators are discussed. The author deprecated the use of excessively high voltages, such as a system for 145,000 volts already in operation and another for 180,000 volts, which is in contemplation. Caution should be used before adopting any high voltages. A few years ago the suspension type of insulator was supposed to have given a solution for line insulation and the factor limiting the use of high voltage was considered to be corona and atmospheric leakage. These views need revision. The uncertain conditions manifested in such a system are the behavior of oil circuit-breakers, the lightning-arrester problem and the high-tension transformers. Most of this apparatus is in the stage of development.

Ralph D. Mershon opened the discussion, stating that there is no doubt that a change in distribution over an insulator takes place with change of frequency. Losses measured by him in the Niagara Falls tests were located on the surface of the insulator. This is explained by the fact that the charging current changes with the frequency. Many insulators which flash over under test are found to puncture on the line not only with metal pins but also with wooden pins. This demonstrates that their behavior at high frequency is not the same as at normal frequency. Similarly, perfectly dry wooden poles are sometimes struck by lightning, which seems to traverse the pole rather than to jump through the air. This occurs with poles which, if tested at normal frequency, would flash over before carrying current. An effort should be made to imitate the effect at high frequency with a test at lower frequency, so that the latter could be specified in a way which would be equivalent to a high-frequency test. The problem of insulating a transmission line is not so much with regard to the line voltage as it is against lightning and similar surges. He consequently did not agree with Mr. Sothman regarding the use of higher voltages from electrical considerations, but he did agree that in many cases higher voltages have been adopted than are justified on the score of economics. Increasing the number of units in the strain insulator will take care of higher voltages, but offers likelihood of mechanical troubles. He objected to the use of the term "string efficiency" and proposed the use of "string ratio" in place of it for indicating the ratio of voltage of flash over per unit for a string of units to the flash-over voltage for a single unit. He illustrated with diagrams why this ratio is less than unity. The string ratio, however, is not a good indication of the distribution of voltage over a string of insulators. The string ratio is different for wet and dry units, since rain does not reduce the flash-over voltage of the space between the units in the same ratio as the flash-over voltage of the unit.

Paul M. Lincoln questioned whether the insulators in the tests of Imlay and Thomas were really subjected to high frequency. The frequency was not measured, but it is inferred from the arrangement of apparatus that a high frequency was obtained. Under the conditions of the circuit as described the discharge is probably alternating, but the rate of decadence is great and it is probable that the maxi-

mum voltage was consequently applied during a single surge. The method does, however, produce an exceedingly sudden application of voltage to the insulator. This lasts for a very brief time, to which fact the observed results are probably due. There is no way of telling how many such shocks the insulator receives during the application, covering a period of one to two seconds. If there were one shock for every alternation, the total would amount to 200 or 300 shocks per application. No data are submitted to judge of this. It appears that the tests were made with a transformer voltage of over 300,000 volts and the low-frequency tests showed that the insulator No. 1 would break down at a voltage of about 200,000, whereas No. 2 would break down at about 300,000 volts. The voltage on the so-called high-frequency tests was, therefore, sufficient to puncture, and the reason it does not first flash over is that for a sudden and brief application the dielectric strength of air is approximately the same as porcelain. It is only when the voltage is maintained for an appreciable time that ionization occurs, which results in flashing over at a much reduced voltage. Breakdown by ionization cannot take place instantaneously. The same effects result in an air-gap measurement of voltage giving results entirely too low. If the calculation of the frequency were based upon consideration of the insulator as part of the circuit, this would not be correct. For the first instant before breakdown occurs this initial frequency would be much higher.

F. W. Peek, Jr., referred to his previous paper before the Institute, in which it was pointed out that a sudden impulse would probably result in puncture rather than flash over, since the corona, which would better distribute the electrostatic stress, would not have time to form. In selecting an insulator it is better to specify a certain flash-over voltage and string efficiency. If an insulator can stand a high voltage long enough for the air to become conducting, a flash-over occurs, otherwise the insulator will puncture. In Mr. Thomas's tests the voltage applied suddenly was more than the porcelain could stand. In insulator tests it is well to specify a ratio between flash-over voltage and puncture voltage in oil, since the latter indicates about what they will stand under high frequency. The cause of high-frequency failure is localized pressure, probably with secondary effects, a sort of pounding effect and if maintained, weakening of the insulation by heating. The needle-and-air-gap method of measuring voltage is not satisfactory at high voltages and should be discarded. The variations are as high as 30 per cent, depending upon humidity, etc.

J. A. Sanford, Jr., agreed that the electrical performance of the insulator having the hook and loop connection was inferior under test, due to the discharge at the point of the hook. However, this type is largely in use both with two-piece and one-piece suspension units, and has given entire satisfaction. No tools are required to connect or disconnect the units in making renewals. There is no difficulty in producing single-piece units of short spacing with an ultimate strength of 12,000 pounds or by slightly increasing the spacing, of 15,000 pounds. Specifying high flash-over tests, wet and dry, necessitates a few units with long spacing, or a larger number with shorter spacing and lower flash-over value. The latter is preferable, but has not been carried far enough. The ratio of puncture voltage of the unit to its flash-over value should be increased, also the flash-over value of single units should be reduced. For factory tests a transformer with the middle point grounded is preferable and gives correct comparative values. The generator should be operated with fairly strong field excitation at all times, further control being obtained by changing the low-voltage connections of the transformer. For measurement of voltage he recommended the voltmeter coil at the grounded neutral of the transformer. He gave an example showing the change in test results due to distortion of wave form. Results were also given showing the effect of the quality of the water in rain tests. He recommended the use of distilled water. The quantity of water used is of secondary importance. He favored a parallel test of competitive insulators, as carried out by Mr. Sothman. Puncture test under oil is of little value, especially when the method is not standardized, as the time element plays an important part as the voltage is raised. A set of standard specifications for routine tests was given.

P. H. Thomas answered some of the points which had been raised and pointed out that the punctures at high frequency did not occur in some cases until after several hundred applications, which he considered fatal to the explanations of Mr. Lincoln and Mr. Peek.

E. E. F. Creighton was then called upon for a demonstration of the method of applying high voltage to insulators. He stated that he had carried on many tests of insulators at high frequencies of late years and was encouraged to find that while the insulators made 10 years ago generally punctured at high frequency, the percentage of loss among modern insulators, especially those of the suspension type, is very small. Professor Creighton explained his point of view of the phenomena involved and offered a hypothesis for explaining the observed phenomena. He pointed out that a spark gap does not always represent the voltage given by the Institute rules. These are correct at ordinary frequency, but no systematic study has been made at high frequencies of the relation of air gap to voltage. He thought this relation would be affected by the dielectric spark lag, the existence of which had been demonstrated. Just what constitutes a discharge is an open question, since currents through the air vary from the invisible conduction and a brush or silent discharge to the spark and arc. During these different stages the potential across the electrodes varies irregularly. At small gaps higher voltage is required to spark between spheres than between needle points, but for very large gaps there is little difference. He did not favor the use of the needle gap for measuring voltage at high frequency. The electrostatic voltmeter also fails under this condition. Electrostatic strains on an insulator cause two distinct phenomena; a direct stress through the porcelain and corona streamers over the surface. He thought that many of the observed phenomena could be traced to flaws in the porcelain, rather than to damage to the good porcelain resulting from rapid alternation of voltage. On the other hand, with glass Leyden jars, evidence shows that it is the heating effect of dielectric hysteresis with high-frequency discharge which causes puncture. These jars have withstood five times as much direct voltage as alternating voltage at 1,000,000 cycles. Repeated flash-over at high frequency acts as a detector of flaws and thus serves to determine puncture. A test for puncture under oil should not be included as a standard test. He discussed the value of high frequency to be used in a test. At low frequencies sparks will jump through the air from the edge of one petticoat to the next, but with increasing frequency tend to follow the longer path over the surfaces. For instance, at 200,000 cycles a discharge was found to completely follow the surface of three petticoats.

Written discussion was submitted by Ralph W. Fope, F. M. Farmer and A. O. Austin.

Ralph W. Pope discussed the use of glass for high-tension insulators. These are used extensively on the Pacific Coast, but do not generally receive the consideration which their merits deserve. In France glass is used extensively up to 100,000 volts. Glass is superior to porcelain in its homogeneity.

In porcelain, the glaze is the main factor in insulation resistance, and differs in composition from the body of the substance, which is far inferior to glass. Recent improvements in glass manufacture have resulted in a more uniform material with higher strength and specific gravity and the desired insulating properties. He explained the changes in manufacture which had brought about this result, which, however, are not generally known to engineers. Designs of glass suspension insulators are available for high-tension lines. One objection to glass insulators is that they could only be used with wooden pins. The more perfectly annealed glass insulators of today are used with iron pins dipped in pitch and equal porcelain in service. Test figures were given for 10 units of glass suspension insulators 10 inches in diameter fitted with malleable caps and eye bolts. These showed a flash-over dry in the neighborhood of 80,000 volts and wet at about 50,000 volts. Under oil, puncture occurred at voltages varying from 89,000 to 185,000 volts.

F. M. Farmer emphasized the need for the standardization of methods of testing insulators and insulating materials. Not only are testing methods of extreme importance but the definition of the terms used in connection with insulators should receive attention. He dwelt upon the importance of careful factory inspection and the necessity for thoroughness, since the continuity of service of an operating company depends very largely upon its insulators. A high-voltage test cannot be relied upon to always weed out the inferior insulators. The amount of resistance and inductance in the high-tension circuit of the test transformer should be definitely stated. The routine electrical tests at the factory should be made as severe as possible, consistent with reasonable cost.

A. O. Austin thought that too much attention is given to wet flash-over values and not enough to surface stress and dielectric strength under line conditions. Insulators having high-surface stress or charging current, such as low-voltage bushings, will be greatly affected by frequency or wave form. Better types of insulators check closely on widely varying types of apparatus. The design of an insulator is necessarily a compromise of the elements producing dielectric strength, surface resistance, flashing capacity and mechanical strength. Since operating conditions on different lines call for different proportions of these elements, it is difficult to draw up special specifications. There are insulators which have been in use for several years which were designed to meet the severe conditions of high-frequency surges. These have the further advantage of multipart construction, enabling a redistribution of stress between the outer and inner surface by making use of the cement zone. Experiments have shown redistribution of stress in insulators through an air discharge invisible to the eye. The only improvement in the suspension insulator, since the tests made by Mr. Sothman, has been an increase in the thickness of material to provide dielectric strength for high-frequency surges. In general insulators of foreign manufacture are superior to American in appearance but very inferior as regards reliability. Dielectric strength is sacrificed for appearance and serious cracking often occurs shortly after installation. As regards line conditions, designs in use in this country are much ahead of those of foreign manufacture.

Secretary of the Interior Fisher Urges Definite Water-Power Policy.

A definite and comprehensive water-power policy for streams in the public domain and navigable streams not in it was urged by the Secretary of the Interior, Walter L. Fisher, as the most important subject pending before Congress and the country, in his annual report submitted to President Taft on December 15. Other legislation which Secretary Fisher recommended embodied an enlarged application of the leasing principle as applied to the public domain in general, a comprehensive leasing law for coal, oil and other mineral lands, and laws providing for the classification of public lands.

The Secretary also wrote in favor of legislation to develop the transportation facilities and coal lands of Alaska and for the withdrawal from entry of public lands in the West needed to conserve the water supply at the sources of streams.

As to water power, he said it must be made certain that those who received special privileges should develop the power to its highest capacity, having due regard to marketing.

"We must make certain," he continued, "that the electric energy thus created shall be made available to the community in appropriate ways at appropriate prices. If it is not to be used for the benefit of the community, some method must be found by which the public shall receive its share of the profits." The present law, he asserted, neither promoted development nor protected the public interest, and he attributed that principally to the fact that a permit was revocable at any time and without specific reason. He called it a "serious and unjustifiable obstacle to the development and utilization of one of the Nation's greatest natural resources." He said conditions should be defined by statute on which permits should be issued, for breach of which only they should be cancelled.

As to Federal as against State control of power concessions on streams not navigable, the Secretary said:

"The suggestion is made frequently by those who are in one way or another representing either present or future investment in water-power development that such power sites and their control should be turned over to the respective States in which they are located. It is interesting to note, however, that the ordinary citizens of those States are not at all concerned over Federal usurpation or unjust treatment. They suspect that the real purpose of those who urge the turning over of the Federal domain to the States is that they may escape the longer and stronger arm of the Federal Government.

"Although certain States undoubtedly have conserved wisely certain of the lands and natural resources turned over to them by the Nation, the story too often has been the acquisition of those lands and resources by special interests or individuals, without adequate recognition of the public interest. In general, all streams susceptible of power development also are of great importance for domestic use, for irrigation and for navigation. All depend to some degree on protection from some source. Increasingly, that source tends to be the Nation and not the States."

Concerning land classification, the statutes, he reported, attempted to recognize in a very general and ineffective way the fundamental differences among agricultural lands still remaining in the public domain. The present system was not flexible enough, he complained.

Secretary Fisher recommended the "adoption of constructive legislation with respect to water-power development and the control and the comprehensive application of the leasing system to the development of our public coal, oil, gas, asphalt, nitrate, potash and phosphate lands, with appropriate provision for the protection of prospectors during a reasonable exploration period preliminary to the leasing of the land. He pointed to the fact that in the Appalachian Mountains the National Forest Reservation Commission was buying lands on which timber could be raised, but which were not good for agriculture, the purpose being to conserve the waters at the heads of navigable streams.

"It is inexcusable," he added, "to permit public lands of this character to be acquired now by private interests, when we are spending public moneys to buy just such lands elsewhere, and may have to repurchase the very lands with which the Government is now parting."

Electrical Installation in a Canadian Nickel Mine.

The conditions in the North Ontario mining district were from the start very favorable to the introduction of electric drive for all mining purposes. Fuel is very expensive in this district and the mines are often located a very great distance from the trunk lines of the railroads, so that the transportation of the fuel becomes a serious problem. On the other hand, the country has many water falls which can be used for the generation of electrical energy with a very small amount of investment for improvements. As a result of this all the larger properties in the Ontario district operate their hoists, pumps, blowers, etc., by electrical energy, which sometimes is transmitted over long distances.

One example of such an installation, which has been in operation over ten years, is the mine of the Mond Nickel Company, at Mond Nickel, on the Canadian Pacific Railroad. This company produces a rich nickel ore from a mine of approximately 1,000 feet depth. The ore is reduced in the company's smelter at Mond Nickel, being conveyed there by a cable-way. The company has its own power station whence power is supplied over a high-tension line to the mine substation and to the substation at the smelter. The substation at the mine is shown in Fig. 1. It is located approximately four miles from the smelter and railroad station. The mine hoist is partly shown

Fig. 1.—Substation, Mond Nickel Mine.

in Figs. 2 and 3. It is a double-drum hoist and is driven by a 300-horsepower, 550-volt Allis-Chalmers-Bullock slip-ring induction motor. The motor is controlled by a series-relay type reversible controller installed to the right of the hoist motor, Fig. 2, and which is in turn controlled by a master drum, shown in Fig. 3. This Cutler-Hammer series-relay controller consists of two double-pole, alternating-current contactor switches with blowouts for the control and reversible of the primary circuit and a number of double-pole switches of the same design for the control of resistance in the secondary circuit of the motor. These secondary switches are in turn controlled by three-phase series relays connected into the secondary circuit in such a way that they prevent closure of the different accelerating switches until the motor has come up to a certain speed and the accelerating current has dropped to a predetermined value, which can be varied by varying the adjustment of the series relays. The master drum is of the multi-step type and is an ordinary cylinder-type drum controller by means of which the operator is enabled to start and reverse the motor and run it at any speed desired. Should he throw the master drum quickly to the full-speed position, the motor resistance would not be cut out suddenly which would result in a heavy overload on the line, but the acceleration is under the control of the series relays described above and the motor will come up to speed gradually without line troubles and without injury to the motor winding. The hoist is stopped by means of hand-operated brakes and is further equipped with an emergency brake, which is set by a falling weight, this weight being held suspended by a latch. Upon failure of the line current, this latch is tripped by an alternating-current solenoid and after the current is re-established the brake is reset by hand.

In the substation there are three transformers which step down the high tension to 550 volts, at which voltage all motors are operated. The substation also contains one 300-horsepower, 550-volt, motor-driven turbine pump for draining the mine; two 75-horsepower blowers, and one 300-horsepower air compressor. The last mentioned motors are all controlled by means of drum-type potential starters, shown in Fig. 4. These starters are mounted in front of the switchboard,

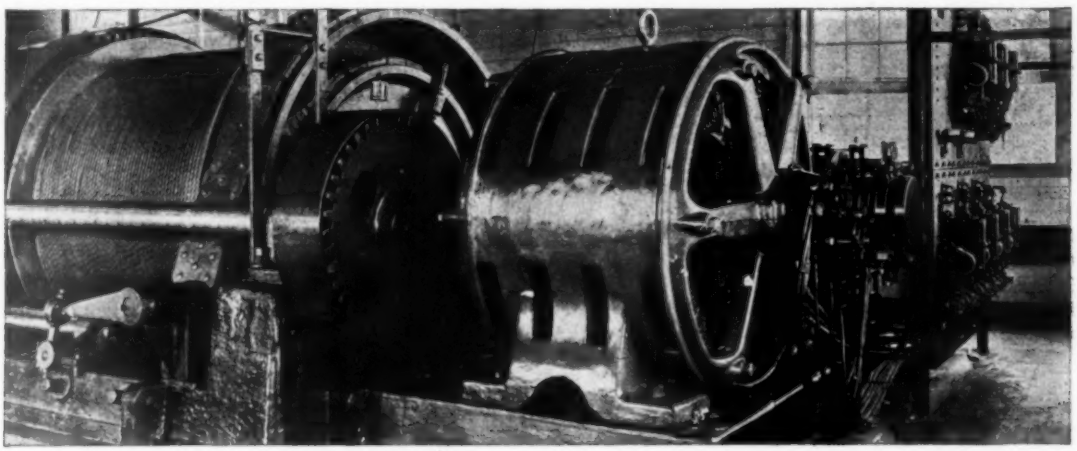


Fig. 2.—Right-Hand Drum of Double-Drum Motor-Driven Hoist.

which contains the necessary indicating instruments and the oil switches for the individual motors. The drums are of the cylinder type and all contacts are oil-immersed. The leads are brought out through the cover of the controller and are sealed with an oil-proof cement, which prevents creepage of oil along the leads. The top forms, at the same time, the support for all contact parts and for the oil case, which consists of a seamless tank. This tank may be lowered by means of crank and chains below the

floor line so that all contact parts are readily accessible for inspection. The top cover rests on a cast-iron ring which is supported from the floor by means of three gas pipes. This type of vertical drum for large size potential starters is very satisfactory for the reason that it can be mounted in front of the switchboard in such manner that the drums are directly opposite the indicating instruments on the switchboard, so that while starting up the motors the operator has a close check of the starting current, the voltage, etc.

The ore is transported from the mines to the smelter, which is a distance of approximately four miles, by a cable-way, this cable-way being driven by a 30-horsepower motor. The cable-way goes over very rough country and the cost of building a railroad to the mine would have been excessive, and it would also have considerably increased the operating expenses.

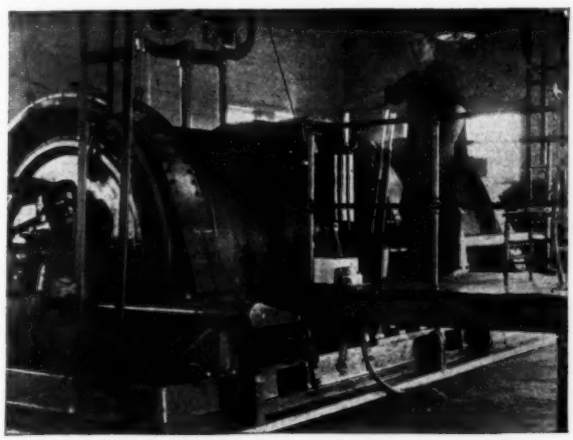


Fig. 3.—Double-Drum Mine Hoist. Master Drum on Operator's Platform.

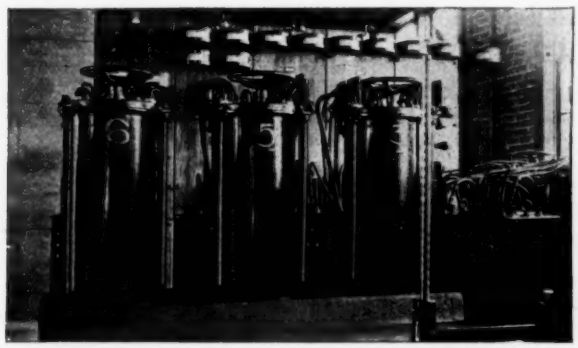


Fig. 4.—Potential-Type Motor Starter for Large Polyphase Motors.

At the smelter there is a second substation with the necessary step-down transformers and a number of blowers and compressors for the operation of the convertors. Besides these an A. C.-D. C. motor-generator set supplies direct current for the motors operating the convertors, the cranes and similar machinery. The smelter has installed at the present time two convertors which work up to their full capacity. The electrical installation is in service for over two years and no interruptions of service have been experienced since the installation with the exception of one or two minor troubles caused by lightning discharges. As a whole the country is fairly free from lightning disturbances, and the discharges on the line usually take place without even opening the circuit-breakers. The disturbances discharge usually across the horn lightning arrester outside of the substation.

The starters and control apparatus for operating the motors used by this company were furnished by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis.

Patent Office Recommendations by Secretary of the Interior.

In his annual report sent to Congress on December 16, Secretary of the Interior Fisher makes some interesting statements and recommendations with regard to the work of the patent office.

During the fiscal year ended June 30, 1912, there were received 69,236 applications for mechanical patents, 1,775 applications for designs, 195 applications for reissues, 7,328 applications for trade-marks, 941 applications for labels, and 362 applications for prints. There were 35,539 patents granted, including reissues and designs, and 4,635 trade-marks, 625 labels, and 268 prints were registered. The number of patents that expired was 19,634. The number of allowed applications which were by operation of law forfeited for nonpayment of final fees was 6,970. The total receipts of the office were $2,094,059.50, the total expenditures were $2,019,236.01, and the net surplus of receipts over expenditures was $74,823.49. The grand total of net surplus receipts over all expenditures is now $7,138,749.25.

Secretary Fisher concurs in the recommendations of the commission regarding the need for a new building for the United States Patent Office. The rapid growth of the bureau since the erection of the present building has overcrowded the working force and has placed in jeopardy the models, patterns and patent records which are not properly stored.

Transcontinental Canadian Wireless.

Communication was recently established between the wireless stations at Queen Island, near Victoria, B. C., and Port Arthur, Ont.

Institute Directors Hold Meeting.

The Board of Directors of the American Institute of Electrical Engineers held its regular monthly meeting on December 13; 55 applicants were elected associates and 119 students were ordered enrolled; 89 associates were transferred to the grade of member and 90 members were transferred to the grade of fellow.

Authority was granted for the organization of an Institute branch at the University of Washington, Seattle, Wash.

A request for an Institute meeting to be held at Pittsfield, Mass., in May, 1913, was considered, but not acted upon.

A resolution was passed authorizing the president to appoint a special committee to make a study of the entire subject of technical committees, some question having arisen as to the advisability of handling additional lines of work through new committees or through subcommittees of the existing technical committees. To this committee also was referred the question of broadening the scope of the work of the Institute and the character and type of the papers to be presented. This followed a discussion as to the desirability of the Institute taking up the subject of depreciation of electrical apparatus and machinery and the allied subjects of amortization, etc.

Great Values in Government Coal Lands.

During the past three and one-half years the United States Geological Survey has classified as coal land 17,459,105 acres in the public-land states, and this land has been restored to sale. The appraised value of this land, as fixed by the Survey as a result of geologic examinations, and promulgated by the General Land Office, aggregates a total of $742,620,649. The minimum valuation for the same lands, at which they might have been purchased a few years ago before the policy of classification was adopted, is but $295,989,140.

An Electrical Kitchen.

Special restaurants for serving electrically cooked food have been established in a number of places, especially where electrical energy is available at a low rate. An interesting kitchen of this kind has been recently installed at the works of the Siemens-Schuckert Company at Gartenfelde, near Berlin, Germany. This kitchen is designed to serve about 300 people and comprises the following equipment: two stoves directly connected with two heating cabinets, with a total maximum load of 15 kilowatts each; one coffee percolator of 35 liters capacity, 1.7 kilowatts; one water kettle of 35 liters capacity, 3.8 kilowatts; three round frying pans, 35 centimeters in diameter, 2.2 kilowatts each; three square frying pans, 40 by 25 centimeters, 1.32 kilowatts each; three frying pans 50 by 34 centimeters, 1.76 kilowatts each, eight pans with capacity of 15 liters, 2.6 kilowatts each; eight pans of capacity of 35 liters, 4.2 kilowatts each. There is also some minor equipment.

The total power requirement of all apparatus operated simultaneously would be 95 kilowatts. The average consumption, however, is considerably lower, as all of the apparatus is never in use at the same time. The pans have double nickel-plated walls with heating at bottom and sides, controlled in four steps. The stoves and heating cabinets are arranged side by side, or above one another, thus reducing the losses by radiation. The outside walls are lined with white enamel and the fittings are nickel-plated. The stoves are designed for both top and bottom heating, controlled separately. The kitchen table is built of stone work covered with enameled plates. Connections are made by means of flexible cords arranged in a convenient manner.

All of the auxiliary apparatus is operated by electricity and the kitchen is well ventilated by the use of electric fans.

Electric Cable Hoists.

One of the most interesting features of the present stage of the work on the dam at Kensico is the operation of the two large cable hoists that stretch for a distance of nearly a half mile across the valley in which the dam is to be built.

The hoists are monsters of their kind and together they are capable of moving 20 tons of earth at one loading. Each has a capacity of 10 tons and is able to shift the weight either vertically or horizontally at the rate of 800 feet a minute.

But the most interesting thing about the hoists and their manipulation is the signaling system used by the operators. The distance across the valley is so great and at the present time the cuts are in such a condition that the operator of the hoists cannot see the bucket at all times, therefore he is forced to depend upon the signaling of a man stationed in the valley below for instructions.

Before each operator is a signaling board divided off into sections. In each section is an incandescent lamp and across the glass covering of the sections are the words, slow, fast, hoist, lower, stop, etc. In the signaling tower in the valley where a lookout is stationed is a keyboard and by the pressing of one button or another the operator is instructed how to move the huge buckets. In spite of the apparent disadvantage the work is carried on very swiftly and the operator is able to place the buckets just where they are wanted.

The hoists are operated by 400-horsepower, three-phase General Electric motors. They are manufactured by the Flory Manufacturing Company of Bangor, Pa. Later when the excavating work is completed they will be used for carrying stone and concrete and other building materials to and from the railroad on one side of the valley. The cables are stretched exactly across the site of the dam and the towers from which they are suspended mark either end of the structure.—*The Edison Weekly.*

Jovian Initiation at New York.

The New York Jovians held a rejuvenation and joviation at Healy's Restaurant, New York, on the evening of Monday, December 16. There were about two hundred Jovians in attendance, and 83 new members were initiated. Joseph F. Becker, statesman, directed proceedings, and W. C. Andrews acted as chairman of the membership committee.

Peoria Electrical Show.

The Peoria Electrical Show Company announces that from present indications all space will soon be sold. Contracts have been closed for decorations, and a number of special attractions have been engaged. The show will be held at the Coliseum, Peoria, Ill., from January 18 to 25 inclusive. A rejuvenation of the Jovian Order is announced for Thursday evening, January 23.

Electrochemists to Meet at Atlantic City.

The spring convention of the American Electrochemical Society will be held at Atlantic City, N. J., on April 3, 4 and 5, 1913. Headquarters will be at the Hotel Traymore.

BOOK REVIEW.

"Der Elektrizitätszähler." By R. Ziegenberg. Berlin: Hermann Meusser. Boards, 352 pages (5¼x8¼ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

While having to do chiefly with the watt-hour meter, this book is written from a somewhat broader viewpoint than the books on the same subject in English. Its appeal is not only to the meterman, but to consulting engineers, public-service commissions and others who are interested in the sale or measurement of electric power. Besides giving, as usual, a brief treatment of general electrical measurements, indicating instruments, etc., special sections are devoted to: instrument transformers and their use, central-station rates and special meter recording devices for them, time counters or devices for determining the length of time a circuit is closed, and other allied topics. The treatment follows German practice rather closely, but for this very reason it should interest the American engineer on account of the many points of divergence from American practice. Of these may be mentioned: the much greater use of the ampere-hour meter, both of the electrolytic and motor types in place of the more expensive watt-hour meter; the pendulum and the oscillating types of meters; also the almost exclusive use of cyclometer dials. While the tendency in America to leave off the tenths dial is meeting with general approval, many German meters have both tenths and hundredths dials, but designated by a different color or in some other way. Considerable space is given to current-limiting devices, to maximum-demand devices, to double-rate meters, which have two dials, to "Spitzenzähler" which are devices for measuring the amount of power supplied at loads greater than a fixed minimum. Perhaps the least satisfactory part of the book is the treatment of tests in position, which is rather brief, but which is necessarily made so by the general plan and scope of the book. There is a very compact outline of the ills to which the watt-hour meter is subject, together with the method of diagnosis and the remedy prescribed for each. The losses in current and voltage coils, the torque, the weight of moving element, and the maker's guarantee of accuracy are given for the various types of German meters. The book is very clearly written and is well illustrated.

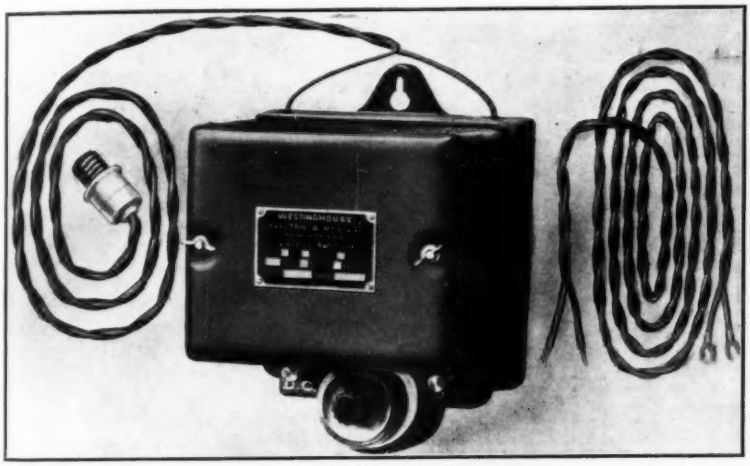
P. G. AGNEW.

According to the United States consul at Para the average rubber yield of the Amazon district is 40,000 tons per annum, of which the United States takes 50 per cent.

New Electrical and Mechanical Appliances

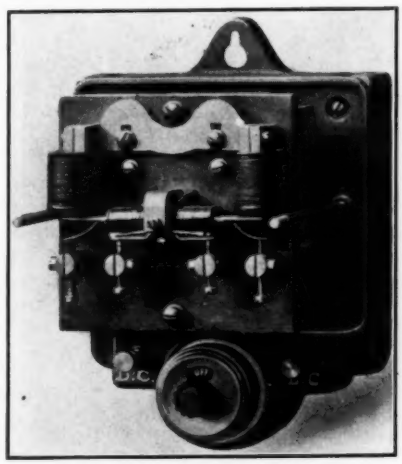
Vibrating Rectifier for Charging Ignition Batteries.

The rectifier illustrated herewith is intended for charging from an alternating-current circuit three-cell lead storage batteries, such as are used for automobile or gas-engine ignition and for lighting automobiles. It is of particular benefit to the motor-car owner who has a three-cell battery equipment, as it enables him to charge his batteries at home directly from his lighting circuit at small cost and trouble.



Westinghouse Vibrating Rectifier Outfit Complete.

The apparatus consists essentially of a polarized relay acted upon by two alternating-current magnets, so that it vibrates in synchronism with the alternations of the current, and is arranged to reverse the connection of the circuit as the current reverses. The vibrating arm is magnetized by current from the direct-current side, so that one end is permanently north and the other end permanently south, depending on the way the battery is connected. The two stationary electromagnets are wound so that their upper ends are of the same polarity at each instant. When the alternating current is in one direction the upper poles of both stationary magnets are north, attracting the south end of the vibrating arm and repelling the north end. This connects the alternating current to the direct-current circuit in one direction. When the alternating current reverses, the poles of the alternating-current magnets become south, attracting the north end of the vibrating arm and repelling the south end. This reverses the connection of the alternating current to the direct-current circuit, but as the direction of current has also reversed, the current flows into the direct-current circuit in the same direction as before. The reversal of the connections thus takes place every time the current reverses, so that the result is a pulsating direct current. A transformer reduces the voltage to the proper value.



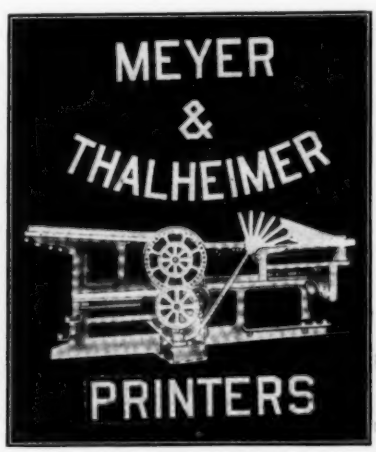
Vibrating Rectifier Mechanism.

The rectifier can be operated on any 60-cycle alternating-current circuit of 100 to 120 volts, and will charge three cells at a rate of 6 to 8 amperes. To charge a battery all that is required is to connect the attachment plug to a lamp socket and the lower binding posts to the battery. No care need be taken as to which pole of the battery is connected to which binding post, as it is immaterial. Should the supply circuit be interrupted temporarily the rectifier will start again as soon as power is restored to the line.

The entire mechanism is mounted in a cast-iron base and inclosed in a removable perforated metal cover that provides ample ventilation for cooling the transformer winding and at the same time thoroughly protects the mechanism. This Westinghouse device is very simple to operate and so compact that it can be conveniently carried along with the tool kit.

Striking Sign for Printers.

The Federal Sign System (Electric), which has been conducting the sign campaign in Baltimore, Md., in cooperation with the Consolidated Gas, Electric Light & Power Company, has recently installed the sign illustrated here for a print shop of that city, and which has attracted much attention by the public. The sign is erected on one of the most prominent thoroughfares and represents a rotary printing press in operation. The paper can be seen feeding into the press, the gear wheels revolving and the spreader taking the finished product and neatly piling it. The words are flashed on and off. This 20-by-12-foot sign contains 673 lamps.



Large Printers' Sign.

Electrical Equipment of the Hawthorne Avenue Bridge, Portland, Ore.

In making plans for the installation of a draw-bridge for Hawthorne Avenue, Portland, Ore., the city officials endeavored to eliminate the many vexatious delays that were due to the constant opening and closing of the old draw-span type of bridge at Madison Street, which formerly occupied approximately the same location as the present structure.

After looking over the various types offered, they finally decided on the lift-span type as being the one which would most effectively alleviate these conditions. This has proven a wise selection on the part of the city officials, as the time required to raise the bridge to the top of the span and lower it is less than that required to swing open the draw-span type. The lift-span type, moreover, possesses an additional advantage in that it is unnecessary in most cases to raise the span more than a few feet to accommodate the greater bulk of the river traffic, and consequently the delays to traffic across this bridge have been reduced to a minimum.

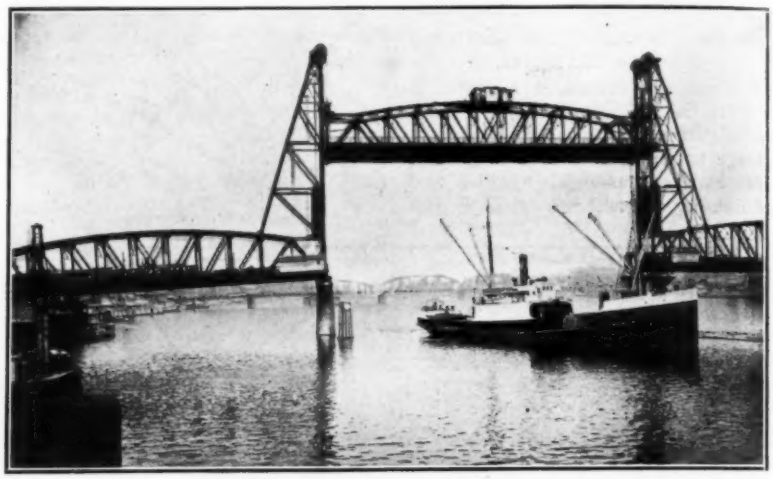
This type of span resolves itself, from an operating standpoint, into practically an elevator proposition, the weight of the span being balanced by means of large concrete counterweights connected to the span by means of steel cables operating over sheaves located at the top of the towers on either side of the span. These counterweights are clearly shown in their position in two of the illustrations herewith.

The bridge is operated by means of two Westinghouse 125-horsepower, 550-volt, direct-current, crane-type motors, which are directly coupled to a train of gears located in the machinery house on the top of the span. This reduction gearing in turn operates the bridge by means of steel cables. The lift span is guided in raising or lowering, by means of steel roller bearings operating in the guides located in the vertical uprights of the tower structures.

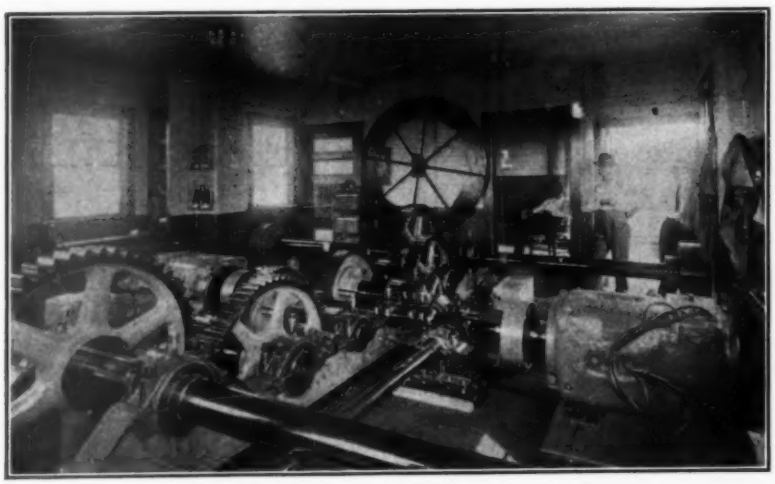
Besides the advantage of greater speed in operation, and consequently less delay to the traffic, this type of bridge also presents three great advantages from an engineering standpoint. (1) There is no unequal expansion or contraction, due to the effect of the sun's rays, as would be the case with the draw-span type pivoted in the center. (2) The wind resistance to operation is practically negligible. (3) It offers the use of the entire channel.

The bridge was designed by Waddel & Harrington, consulting engineers, Kansas City, Mo., and was erected under the supervision of Leon Clarke, engineer in charge. The electrical equipment, including the motors and control apparatus, was furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

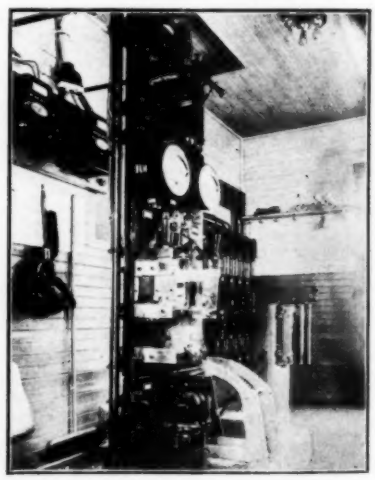
General View of Bridge.



Lift Span of Bridge Raised.



View in Machinery Room, Showing Motors and Gears.



Switchboard and Operating Room.

Double-Arm Exploring Mirrors for Arc-Lamp Photometry.

The Leeds & Northrup Company, Philadelphia, Pa., is just placing upon the market a double-arm exploring mirror for use in photometering arc lamps and other large units. The device is clearly shown in the illustration. Two large mirrors, each 18 inches by 22 inches, are mounted upon the outer ends of counterweighted arms which are capable of rotation about a common axis. The height of this axis from the floor is adjustable and is made

Exploring Mirrors for Photometry.

to correspond to the height of the photometric axis of the photomter employed in the measurement. The arms may be conveniently clamped in any angular position around the lamp, a scale graduated in degrees being provided. The mirrors are adjustable and are to be so arranged that the light rays from the lamp under test are thrown upon the screen of the photometer sight box.

In using the device, the mirrors are placed symmetrically about the lamp on either side of a vertical axis. In this way an average value is obtained of the candlepower of the lamp at the particular angle at which the mirrors are set. It is evident that this is particularly advantageous in measuring electric arc lamps, for in such lamps the jumping of the arc makes accurate determinations with one mirror practically impossible.

The arms have been very carefully designed from the standpoint of rigidity. They are made of ribbed metal castings. Very careful tests have proven that under the worst conditions no appreciable error will be introduced into the results due to either twisting or bending of the arms.

Reco Cabinet-Type Flasher.

One of the greatest strides in flasher construction has recently been made by the Reynolds Electric Flasher Manufacturing Company, of Chicago and New York, which is a pioneer in the flasher business. Recognizing a long-felt want for a compact, inclosed-in-iron

Reco Cabinet-Type Flasher With Cabinet Open for Inspection.

cabinet, simple and reliable motor-driven flasher, the company designed the cabinet type shown in the accompanying illustration.

The opening of the cover discloses the inner parts, which consist of an electric motor specially built for continuous flasher duty, a train of gears, a revolving brush, four contacts, necessary fuses and terminals.

This construction involves an entirely new principle, since the only moving current-carrying member is the feeder brush. The contacts being stationary, wear and liability for trouble are reduced to a minimum. With this method an unusually "quick break and make" is obtained and loads up to ten amperes per contact are handled with little or no arc.

The flasher may be used to flash from one to four circuits. All connections, including those for the motor, are made and in connecting the cabinet type to the service it is only necessary to run mains to various binding posts. The housing is of cast iron. is weatherproof and meets all Underwriters' rules.

The size of the flasher is 10.5 by 9.5 by 5.5 inches, which permits installation in the smallest places. The Reco cabinet flashers open a large new field on account of the ease and small expense of installation and low initial cost.

Ozone Electric Blanket.

The hygienic benefits to be derived from sleeping where an abundance of fresh air is available have made it increasingly popular to sleep outdoors, or on airy sleeping porches, or at least to open wide the windows of the bed chamber. Now in cold weather this involves special sleeping bags or an abundance of warm blankets, quilts or comforters, in order to keep the sleeper comfortably warm. However, the weight and clumsiness of thick bed covering are irksome to many persons.

In order to meet the demand for a light-weight warm blanket the National Electric Company, 506 South Fifth Avenue, Chicago, Ill., has placed on the market an electrically heated blanket made on the principle of the popular

Ozone Electric Blanket for Comfortable Fresh-Air Sleep.

electric heating pad. Being intended particularly for fresh-air sleepers, it has appropriately been called the Ozone electric blanket. Its use has been found a great comfort for strong persons and a practical necessity in order that weak and aged people may enjoy the invigorating effects of sleep in fresh air.

The blanket is very soft and flexible and is of the best sateen material in three colors, red, old rose and blue. It may be folded into a very compact form. The heating element is a fine but strong black-enameled wire which is carefully sewn in place between the outer and inner layers of the blanket. The wire is so proportioned in resistance that it takes only about 50 watts on standard 110 to 120-volt circuits and can carry over one-half ampere continuously without dangerous heating. Taking 50 watts throughout the night, its operating cost for an eight-hour sleep is only four cents at the common rate of ten cents per kilowatt-hour. The wire being well insulated, with no

portion exposed, there is no possibility of shock, even though the covering may become moist, as often is the case from condensation of the moisture of the breath or from snow.

When the bed is outdoors, on a sleeping porch or in an unheated room, it may be warmed by turning on the current to the blanket about half an hour before retiring and throwing another light blanket over it to hold in the heat generated. During the night the electric blanket supplies enough heat to replace that given off by the body; at the same time it does not obstruct the vapors given off in perspiration of the skin, as is the case when heavy bed covering is used.

Ozone electric blankets are made in two sizes, suitable for what are commonly known as single and double beds.

The Palmer Meter Seal.

The comparative value of a seal depends upon the penalty involved in its violation, and the clearness with which it indicates the fact as to whether or not it has been tampered with. By clearly indicating the latter fact is meant that its construction is such that when installed it is impossible to open the seal and then close it so that the fact that it has been opened and closed illegally is not instantly apparent at a cursory glance.

The S-1 Palmer seal is supplied with a destructible sealing member made of a specially prepared paper, bearing a statement that indicates its use, and prohibits its destruction, over the signature of an authorized officer of the company using the device. This destructible paper part is readily renewable by means of a similar paper supplied to the users ready for installation, and it may readily be placed in the seal holder, the latter engaged with the meter and locked closed.

It is impossible to attach the seal to the meter so that it may be opened without destroying the paper, and as it would be necessary to both counterfeit the paper and forge the signature of the company officer in illegally replacing the device, its value as an effective seal is readily apparent.

These seals are made by the Palmer Electric & Manufacturing Company, 161 Franklin Street, Boston, Mass.

Meter With Palmer Seal In Place.

Seal Holder, Strap and Nut.

Market for Vacuum Cleaners in Hungary.

United States Consul Samuel H. Shank, of Flume, Hungary, states in a consular report that vacuum cleaners for private use are not on sale in that district. Dealers say that they have been offered cleaners of German and domestic make, but that they have never put them on sale, as the price was such that they did not think there would be a sale for them. This price ranges from $100 to $125. The city has a large vacuum cleaner, which it rents for $9.13 for eight hours or $5.07 for four hours, with three men.

Owing to the strong wind which is prevalent there dust in the houses is very great, although all houses are provided with double windows. It would seem that vacuum cleaners should have a ready sale, if the price were not too high. It seems that the necessity is to make a start, so that the dealers as well as the buyers may see the practicability of the machine.

Pelouze Parcels-Post Scales.

On January 1, 1913, the new Parcels Post Law will become effective. Thereafter fourth-class mail matter "shall embrace all other matter, including farm and factory products, not now embraced by law in either the first, second or third-class, not exceeding 11 pounds in weight, nor greater in size than 72 inches in length and girth combined, nor any form or kind likely to injure the person of any postal employee or damage the mail equipment or other mail matter, and not of a character perishable within a period reasonably required for transportation and delivery." For the purpose of carrying this law into effect the United States is divided into zones with different rates of postage applicable to each.

Fig. 1.—Parcels-Post Scale No. 1.

Undoubtedly there will be many opportunities for the manufacturers of electrical material, electrical supply houses and dealers in electrical fittings to take advantage of the Parcels Post Law. One of the necessary adjuncts to complying with the rules governing the Parcels Post service is the accurate weighing of the articles to be carried. To facilitate this service the Pelouze Manufacturing Company, 232 East Ohio Street, Chicago, Ill., has placed on the market a parcel-post scale to conform with the new law. These scales indicate automatically in cents the cost of postage on parcels in the United States according to zones. A copy of the law accompanies each scale. The scales are enameled in blue and appropriately ornamented, and the dials are distinct and placed in a slanting position, making them easy to read. Fig. 1 shows the No. 1 scale equipped with glass sash and nickel rim. Fig. 2 shows the No. 2 scale with enameled dial.

Fig. 2.—Parcels Post Scale No. 2.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

BREWSTER, MINN.—There is talk of installing a municipal electric light plant here. C.

WAYLAND, IOWA.—D. D. Bentzinger has been granted a franchise for electric lighting. C.

MURPHYSBORO, ILL.—The City Council is contemplating a change in the lighting system. Z.

AMES, IOWA.—The City Council contemplates installing an electric light plant to replace the present one.

BOYDEN, MINN.— The village voted bonds for installing an electric light plant. The plant will cost $7,500.

OAKVILLE, IOWA.— The town voted to grant a franchise for electric lighting to R. B. Vaught, of Burlington. C.

LE CLAIRE, IOWA—The Electric Construction & Machinery Company of Rock Island, Ill., will install an electric light system. C.

HOT SPRINGS, ARK.—The Business Men's League is interested in a proposition to give Hot Springs a "Great White Way."

ELIZABETH, N. J.—The Public Service Electric Company has obtained permission to place its wires in this city underground.

JOURDANTON, TEX.—G. B. Smith of San Marcos, Texas, will install an electric light plant, ice factory and bottling works here. D.

CHELSEA, IOWA.—The Council has granted a franchise for electric lighting to William G. Dows and others of Cedar Rapids. C.

ALAMEDA, CAL.—Bids will be received until January 7 for furnishing the Department of Electricity with electroliers, lamp posts and tops.

WILLOWS, CAL.—The Oro Electric Company has applied for a franchise in Glenn County. Bids will be received for the same until January 7.

STOCKTON, CAL.—Bids will be received until January 7 for the blanket franchise in San Joaquin County, applied for by the Oro Electric Company.

LOUISVILLE, KY.—The Commercial Club of this city is preparing plans for a "White Way" system of street lighting for the important streets of Louisville.

WEBSTER CITY, IOWA.—The Councilmen of Eagle Grove have proposed to the Webster City Electric Light Company that the latter run a wire to their town.

BUFFALO, IOWA.—It is understood that the Davenport & Muscatine Interurban Railway Company proposes to establish an electric light and power plant in this town.

FREEHOLD, N. J.—The City Commissioners are making an investigation of the merits of a municipal electric lighting plant, which it is estimated would cost the town $25,000.

ARMSTRONG, IOWA.—The vote on granting a franchise to the Armstrong Cement Works for an electric light, heat and power plant and service was in favor of granting a franchise.

SHAWANO, WIS.— The Electric Light and Water Commission will look up a site for a municipal water power plant. Estimates will be prepared for a dam and plant for electric lighting. C.

MOUNT HOREB, WIS.— The Mount Horeb Heat, Light & Power Company has been incorporated with a capital stock of $25,000 by M. C. Mathison, Grace E. Mathison and Carl J. Mathison.

WHITING, IOWA.—It has been decided to bond the town for $10,000 for the purpose of installing an electric light and power system. The system to be installed is to be a thoroughly complete one.

BRIDGETON, N. J.—The Board of Public Utility Commissioners has approved of a bond issue of $75,000 by the Bridgeton Electric Company, to be used for extension in the company's local electric plant. A.

PORT CLINTON, O.—More than $25,000 will be spent here by the Northwestern Electric Railway & Power Company in improving its plant and incidentally furnishing a better lighting system for the city. H.

NEENAH, WIS.—Mayor C. B. Clark has appointed a committee to investigate the feasibility of installing a municipal lighting plant in this place. It is estimated that such a plant would cost $50,000 or more.

DENISON, TEX.—The Texas Power & Light Company plans to erect a mammoth power and light plant just north of this city in the near future and enter the local field for the sale of light, power and heat.

FULDA, MINN.—The Fulda Electric Light & Power Company plans an extension to Kinbrea and Dundee, and will supply farmers along the route with electric service. Contracts are to be made with the towns for street lighting. C.

TRENTON, N. J.—The South Jersey Gas, Electric & Traction Company has been granted permission by the State Board of Public Utility Commissioners to issue bonds for $139,000 for extensions in its plants and systems. A.

ELIZABETHTOWN, TENN.—The Watauga Power Company has sold $300,000 worth of bonds in New York City to finance the construction of transmission lines from its plant to Jonesboro, Morristown and Greenville. G.

RAYMOND, WASH.—The Twin City Electric Company has announced that it will begin immediately to rebuild practically the entire lighting system in this city and make extensions to many districts not heretofore served.

NORDHOFF, CAL.—The Ojal Power Company has been granted permission to issue $25,000 in bonds for the construction of an electric light plant in this city. It has also been granted a certificate of public convenience and necessity to exercise franchise rights.

MINNEAPOLIS, MINN.—The Public Lighting Committee of the City Council asks for bids on lighting the streets with electric arc and ornamental lights, gas lamps and lighting service, according to a plan proposed by City Gas Inspector A. D. Meeds.

AURORA, MINN.— The Great Northern Power Company is surveying near here and it is rumored will supply the range cities. Northern Minnesota Power Company has been organized by local people, with a power site on the St. Louis River south of here. C.

MIDDLETOWN, N. Y.—New York & New Jersey Power Corporation has been incorporated with a capital stock of $100,000 for the purpose of dealing in and furnishing electricity. The incorporators are Edward A. Abbey, Charles A. Bruce, and Thomas Roberts.

FINDLAY, O.—The local Business Men's Club has taken up the matter of a municipal lighting plant for this city. The lease with the Bowling Green Southern Traction Company for lighting the streets expires in a year and the City Council is already looking forward to the building of a municipal plant.

ST. LOUIS, MO.—A new corporation known as the Western Power & Light Company has been organized to compete with the Suburban Electric Light & Power Company. H. C. Garneau, F. R. Mott and Joseph Dixon are the incorporators. The company proposes to establish its power plant at Clayton.

ANOKA, MINN.—The Great Northern Improvement Company has taken over the rights of the C. C. Cokefair interests in the power rights at Cook Creek on the Mississippi River and will proceed with the construction of an electric power plant. It is also rumored that an electric railway may be built to Camden Place, North Minneapolis. C.

RIVER ROUGE, MICH.—Engineer Patrick Keating has been employed by the Council of this place to supervise the $15,000 improvements which are to be made to the lighting system. The work will include changes in the overhead construction and the installation of additional machinery. It is stated that work will commence as soon as possible.

CHICAGO, ILL.—The Continental Coal Corporation is entering into contracts with H. M. Byllesby & Company,

of Chicago, it is reported, which will result in the establishment of a mammoth electric light and power plant in Bell county, Ky., to furnish current for mine lighting and operation throughout the extensive coal properties of the corporation in that territory. G.

CHATTANOOGA, TENN.—W. C. Houston, of Nashville, Tenn., has sold the electric power plant at South Pittsburg, Tenn., to J. W. Adams, of Chattanooga, for $6,500. The new owner will install a new 100 horsepower engine and will later secure his power from the station of the Tennessee Railway, Light & Power Company at Parksville, constructing a railway between South Pittsburg and Richard City. G.

ROCKDALE, TEX.— To deliver electrical energy anywhere in Southwest Texas at less than one-half the present cost of production, and thus make this the great manufacturing district of the south, is contemplated in the plans of J. C. Dumont, a French engineer. The power is to be created at Rockdale, where a great plant is to be erected, plans for which have already been prepared, and the power transmitted by insulated copper cables, as is now done from hydroelectric plants in various parts of the country.

JACKSON, MICH.—It is understood that the Commonwealth Power Company proposes to float a bond issue of $457,000 to be used for extensions and additions to be divided as follows: Pontiac Power Company, $5,000; Flint Electric Company, $9,000; Consumers' Power Company, of Kalamazoo, $19,000; Bay City Power Company, $4,000; Saginaw Power Company, $27,000; Grand Rapids & Muskegon Electric Company, $92,000; Economy Power Company, $14,000; Commonwealth Power Company, of Jackson, $86,000; Au Sable Electric Company, $201,000.

ALBANY, N. Y.—A merger of the Schoharie Light & Power Company, the Catskill Illuminating & Power Company and the Upper Hudson Electric Company has been effected, the new company to be known as the Upper Hudson Electric & Railroad Company. The new company, which will supply light, heat and power to Albany and adjacent places, has a capital stock of $500,000. The directors include Edwin A. Stevens, Frank Stone Tainter, of Hoboken; Marcus H. Norton, Brooklyn; Henry W. Showers, Jeremiah Shehan, Eugene Wolf and Fred W. Titus, of New York City.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CLE ELUM, WASH.—The Pacific Telephone and Telegraph Company has been granted a franchise here.

CHECOTAH, OKLA.—The Pioneer Telephone Company is planning the reconstruction of its telephone system here.

WEST, TEX.—The Brazos Valley Telephone Company is arranging to make extensive improvements to its exchange here. D.

AITKIN, MINN.—An extension of the Aitkin-Deerwood telephone exchange to Pine Knoll, Cedar Brook and Deer Lake is probable. C.

ST. CLOUD, MINN.—The Tri-State Telephone Company is figuring with the Fire Department for installing an underground system for its wires. C.

EUGENE, ORE.—The Lancaster Telephone Company No. 2 has been organized, with Hans Albertson resident, to run a line from this city to Junction City.

SALEM, N. J.—The State Board of Public Utility Commissioners has approved of an ordinance granting the Delaware & Atlantic Telegraph & Telephone Company a franchise throughout Elsinboro Township. A.

PRESCOTT, ARIZ.—With the completion of the double tracking of the main line of the Santa Fe between Yavapai and Ash Fork, the Postal Telegraph Company will install telephone service from this city to Seligman.

VIRGINIA, MINN.—The telephone franchise ordinance which was presented to the Council provides for a local telephone exchange system, but contains the name of no company and is therefore available to the highest bidder. C.

TAMPA, FLA.—The Peninsular Telephone Company is preparing to erect a large building and install an automatic telephone system in this city. It is said that arrangements for financing the project have been made and that construction work will be started in the near future.

SAUGUS, MASS.—A new telephone exchange and the installation of a common-battery switchboard is scheduled for this place in 1913. It is estimated that $22,000 will be expended on betterments to the service, including the new switchboard.

PITTSBURGH, PA.—It is said that the Bell Telephone Company has spent $850,000 in Allegheny County alone on improvements in the last year and that at least the same amount will be expended in 1913.

MARIAVILLE, N. Y.—Mariaville & South Schenectady Telephone Company, Incorporated, has been granted articles of incorporation, capitalized at $500. The incorporators are Robert C. Cullings, Pattersonville; C. A. Cullings, Delanson, and Mary B. Walpole, Mariaville.

WACO, TEX.—The South Texas Telephone Company has moved its principal office from Austin to Waco. It is also preparing to extend its long-distance lines and enlarge the scope of its business in other respects. According to a recent amendment to its charter it is authorized to transact business in over 50 counties. D.

ROCK ISLAND, ILL.—A 25-year franchise has been granted to the Tri-City Automatic Home Telephone Company to operate a telephone system. The company already has a franchise to operate in Moline, Ill., and the proposition was ratified by the voters of Davenport, Iowa, but must be passed upon by the Davenport Council. Z.

TOLEDO, O.—Harry B. Kirtland, captain of the Toledo Signal Corps, has made arrangements and secured Government sanction for the erection of a powerful wireless station to be established at Put In Bay to convey news of the Perry Victory Centennial celebration next summer to an equally powerful receiving station to be established at the Toledo Armory. Both stations will to some extent be under Government control. The plans are all prepared and it is expected to have the new wireless apparatus installed by February. H.

ELECTRIC RAILWAYS.

(Special Correspondence.)

GREAT FALLS, MONT.—It is understood that the Great Falls Electric Company properties will construct a street car line on First Avenue, North.

LETHBRIDGE, ALTA.— English capital is being interested in a project for an electric railway from this city to the mines, about 25 miles. C.

DENVER, COLO.— The Denver, Colorado Springs & Pueblo Interurban Electric Railroad Company has been granted articles of incorporation by the Secretary of State.

CHARLESTON, ILL.—The Coles County Board of Supervisors has granted the Decatur, Sullivan & Mattoon Transit Company right of way over the highways of Coles county. Z.

QUINCY, ILL.—The Adams County Board of Supervisors has granted a franchise to the Quincy Street Railway Company to extend its tracks on Maine Street to Graceland Cemetery grounds. Z.

BRAZIL, N. D.—A. J. Fox has begun the organization of a company to be known as the Brazil, Devils Lake & Minneapolis Electric Railway Company. Gasoline-electric cars may be used. C.

MARSHALL, ILL.— The Clark County Board of Supervisors has granted a franchise to the Springfield & Central Illinois Traction Company to use the highways of the county for its interurban line. Z.

CLEVELAND, O.—It is reported that the Cleveland, Southwestern & Traction Company has been surveying in the vicinity of Mount Vernon for the proposed extension of the line from Mansfield to Columbus.

MARTINSBURG, W. VA.—C. E. Martin, who was granted a franchise some time ago to construct a trolley line, has filed a bond of $2,000 to commence work on the proposed car line by April 1, next.

OMAHA, NEB.—The Citizens' Interurban Company proposes to construct an electric interurban line from Havelock to Omaha, and it is estimated that the cost of this project will be $2,000,000.

RICHMOND, CAL.—The San Francisco-Oakland Terminal Railway Company, owner of the local street car system, is planning to extend its lines east on Richmond Avenue, as soon as the hillside territory and the harbor is improved.

EVANSVILLE, IND.—At a recent meeting of the directorate of the Evansville, Chrisney & Eastern Traction Company, it was decided to rush the construction work upon divisions to Boonville and Lynnville as rapidly as possible. G.

LOUISVILLE, KY.—The Louisville & Northern Railway & Lighting Company may extend its lines in Jeffersonville, Ind., to serve the Walnut Ridge cemetery. The improvement has been solicited by residents of Jeffersonville. G.

LOUISVILLE, KY.—The Louisville & Interurban Railway Company is considering an extension of its division to La Grange, Ky., so as to serve the eastern half of La Grange and to meet the Louisville & Nashville Railroad at that point. G.

MONTEREY, CAL.—The Monterey & Pacific Grove Electric Railway Com-

pany has been granted a franchise in this city on its bid of one per cent of its gross annual receipts for the first five years, and two per cent annually thereafter.

BRYAN, TEX.—The Bryan-College Interurban Railway Company is preparing to extend its line down the valley of the Brazos River for several miles. The route of the proposed extension is through a thickly populated section. O. E. Gammill is general manager. D.

CHATTANOOGA, TENN.— John W. Adams, of this city, has purchased the electric light plant of South Pittsburg, Tenn., and many improvements are to be made. The new proprietor, it is stated, intends to build an electric line between South Pittsburg and Richard City within a few months.

YOUNGSTOWN, O.— The Lake Erie & Youngstown Railway Company has been incorporated with a capital stock of $300,000 with Asa W. Jones, Ex-Lieutenant Governor, as one of the incorporators. The company proposes to operate an electric line between Youngstown and Conneaut.

MARSHALL, ILL.—The City Council has granted a 50-year franchise to the Springfield & Central Illinois Traction Company to construct and operate an interurban railway through the city. The franchise provides that the line must be constructed before the expiration of two years. Z.

ROGERS, ARK.—The City Council has granted the Northwest Arkansas Railroad Company a franchise to operate a street-car line in this city. The company proposes to operate an electric line from Rogers to Bentonville and Pea Ridge. It is expected that the road will be extended trom Pea Ridge to Joplin, Mo., at a later date. The new road will handle freight and passenger traffic.

KOKOMO, IND.— Articles have been filed of the merger of the Kokomo, Marion & Western Traction Company, the Kokomo, Frankfort & Western Traction Company and the Kokomo Public Utility Company. The name of the new company is the Indiana Railways & Lighting Company and the capital stock is $3,000,000. It is proposed to extend the interurban, lighting and heating business of this corporation.

DALLAS, TEX.—According to an announcement made by J. V. Watkin, president of the Trinity Valley Traction Company, his company will soon begin the construction of an interurban electric railway between Dallas and Austin. It is understood that financial arrangements for constructing the proposed line have been made. The route will be via Waxahachie, Marlin, Hubbard City and several other thriving towns. D.

PITTSBURGH, PA.—The Pittsburgh, Steubenville & Wheeling Electric Railway Company is said to have completed a survey for an electric line to extend from Pittsburgh, through Burgettstown, Avilla, Independence, Bethany, West Liberty, Greggsville, Fulton and to the city of Wheeling, W. Va. W. E. Hildebrand, of Pittsburgh, is president of the company. The proposed route would open up a rich country about midway between the Ohio River and the Baltimore & Ohio railroad from Wheeling to Pittsburgh, in all a distance of 51 miles.

CLOUDCROFT, N. M.—Morgan Hand, of Kansas City, Mo., who is connected with the General Electric Company, and C. C. Carroll are promoting the construction of an interurban electric railway to run between Cloudcroft and Carlsbad, a distance of about 100 miles. The route will follow the Penasco River most of the distance and will strike the Pecos Valley at or near Dayton. The plans of the promoters contemplate the installation of a hydroelectric plant on the Penasco River to provide power for the operation of the line and also for the towns of this section. D.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following item should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.)

NO. 10,063. ELECTRIC VACUUM CLEANERS.—An American consular officer in Canada reports that a member of a firm in his district wishes to correspond with some American firm that handles electric vacuum cleaners. Correspondence may be in either French or English.

PROPOSALS.

CABLE TERMINALS.—Sealed proposals will be received by W. M. Bostwick, Jr., Jacksonville, Fla., until January 6 for furnishing 1,200 single-conductor cable terminals.

STEEL REFLECTOR FIXTURES.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until January 7 for furnishing 255 steel reflector fixtures to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5060.

LONG-BURNING ARC LAMPS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until January 7 for furnishing 20 long-burning arc lamps to be delivered at the the Navy Yard, Brooklyn, N. Y., as per Schedule 5060.

TELEPHONE SYSTEM.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until December 30 for an intercommunicating telephone system for the Supervising Architect's office, in accordance with drawing and specification, copies of which may be obtained from the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 21, 1913, for the electric conduit and wiring and interior lighting fixtures of a one-story building for the post office at Red Oak, Iowa; until January 23 of a three-story building for the post office at Billings, Mont. Drawing and specifications may be obtained from the office of the Supervising Architect.

NEW PUBLICATIONS.

THERMOMETRIC LAG.—Technical Paper No. 185, issued by the Bureau of Standards, Washington, D. C., is entitled "Thermometric Lag," by D. R. Harper, 3rd. This deals with the lag of electrical as well as mercurial thermometers. Both thermoelectric couples and resistance thermometers are considered and the necessary corrections in calorimetric work determined.

CANADIAN STRUCTURAL MATERIALS.—The Canadian Department of Mines has issued an advance chapter of the annual report of mineral production during 1911. This deals with cement, lime, stone, clay products and other structural materials. Figures are given showing the production and consumption, with comparisons with previous years.

IRON AND STEEL IN CANADA.—The production of iron and steel in Canada during 1911 is treated in a publication of the Canadian Department of Mines by John McLeish. This gives statistics for the production of ore and of different grades of iron and steel for several previous years as well as for 1911, and the imports and exports of iron and steel products.

REPORT OF GEOLOGICAL SURVEY.—The thirty-third annual report of the Director of the United States Geological Survey is being issued. This covers the fiscal year ending June 30, 1912. The work of the department for the year is reviewed, and figures given showing the amount of work done in both office and field. The urgent need of a new building for the survey is emphasized and the policy regarding land classification is explained at some length.

NEW INCORPORATIONS.

SNYDER, TEX.—The Snyder Ice & Light Company has been incorporated with a capital stock of $25,000. The incorporators are E. W. Clark, P. L. Fuller, M. A. Fuller, all of Snyder.

CLEVELAND, O.—The Republic Electric Company has been incorporated with a capital stock of $10,000 to deal in electrical machinery. The incorporators are Louis Griesser, A. S. Mann, Solomon Peakind, Edna LaHarte and G. E. Mann.

ST. LOUIS, MO.—The Minot Electric Manufacturing Company has been incorporated with a fully paid up capital stock of $50,000 for the purpose of manufacturing electric heaters. The incorporators are Cady and John T. Brown, Charles F. Pezolt, S. J. Thorwegen and J. I. Finnegan.

NEW YORK, N. Y.—Schaumann Talcott Company, Incorporated, has been granted a charter with a capital stock of $1,000 for the purpose of dealing in electrical accessories. The incorporators are Frederick L. Talcott, Ralph M. Schaumann and Gustave Q. Schaumann, all of New York City.

CHICAGO, ILL.—The Brown-Lewis Railway Supply Company has been incorporated with a capital stock of $2,500 to manufacture and deal in motor, tractor and trailer trucks, and all steel products. The incorporators are Frank T. Murray, Charles W. Paltzer and Frank S. Righeimer. Z.

SALEM, ORE.—Articles of incorporation have been filed for the Northwestern Electric Company with a capital stock of $10,000,000. H. A. Mitchell is president and Charles Barnard, of Portland, is general agent. The company proposes to generate, transmit and furnish electricity for light, heat, power, to operate railroads, lumber mills, mercantile establishments, telephone and telegraph lines.

FINANCIAL NOTES.

There were several irritating and disconcerting features to the financial aspect of things last week. This led to pretty wide swings in the price of not a few industrials, with closing figures for the week showing a negative sign of anywhere from one to seven points.

A new corporation, with Marshall E. Sampsell, of Mattoon, as president, F. S. Peabody, of Chicago, and A. Christ, of Anna, as vice-presidents, and R. B. Donnelley, of Mattoon, as secretary and treasurer, has taken over the following plants: Fruit Growers' Refrigerating & Power Company, Anna; Central Ice Company, Mounds; Citizens' Water, Light & Power Company, Carbondale; Interurban Electric Company, Carterville; Interurban Electric Company, Herrin; Fruit Growers' Refrigerating & Power Company, Marion; Marion Light, Power & Water Company; Johnson City Electric, Gas & Water Company, and People's Light, Water & Power Company, Harrisburg. The new company is known as the Central Illinois Public Service Company, with general offices at Mattoon. The concern intends to accommodate various districts from one power plant, distributing energy to all small towns where the patronage warrants.

Permanent organization has been perfected by the $100,000,000 Montana Power Company, which was incorporated at Trenton, N. J., last week, by the election of the following officers and directors: President, Charles W. Wetmore; vice-presidents, Max Hebgen, Charles Norman Fay, Alfred Jaretzke and Charles R. McCabe; secretary and treasurer, P. E. Bisland; assistant secretary and treasurer, Henry F. Kroyer; directors, W. S. Brayton, of East Orange, N. J.; George F. Canfield, Percy Chubb, Charles Martin Clark, Charles A. Coffin, William E. Corey, Marcus Daly, Charles Norman Fay, Alfred Jartzki, Sydney Z. Mitchell, Charles H. Sabin, Frederick Strauss and Charles W. Wetmore, all of New York City; W. K. Wigham, London; Thomas F. Cole, Duluth, Minn.; J. G. Schidlapp, Cincinnati; Elliott Wadsworth, Boston, and Max Hebgen, John G. Morany, John D. Ryan and William G. Thornton, all of Butte, Mont. This concern is a consolidation of the Butte Electric & Power Company, the Montana Power Company and Madison River Power Company, the Billings & Eastern Montana Power Company and the Missouri River Electric & Power Company.

G. H. Walbridge, president of the Central Colorado Power Company, which was recently placed in the hands of receivers by the Federal Court in session at Denver, recently arrived in Denver from New York to complete arrangements for the reorganization of the power company. Walbridge was appointed co-receiver by the court when the company was declared insolvent.

Instead of having outstanding stocks and bonds representing in money value $34,485,000, as at present, the new company will have but $12,509,039. According to plans formulated, arrangements will be made in the near future for the issuance of $10,500,000 in securities to pay for improvements and extensions of lines contemplated.

The new company will issue $4,000,000 seven-per-cent bonds, $15,000,000 common stock and $10,000,00 first-mortgage, three-year, five-per-cent bonds. To bring about the reorganization there will be issued $325,762 preferred stock, $8,814,037 common stock and $3,369,250 in bonds. Those holding $10,490,000 in first-mortgage bonds of the present company will receive $2,612,250 in bonds and $7,836,750 in common stock of the reorganized concern. The holders of $1,303,050 second-mortgage bonds of the original company will be credited with $977,287 common stock and $325,762 preferred stock of the new company. Par in bonds of the new company will be received by holders of the $757,000 first-mortgage bonds of the Leadville Light & Power Company, which is controlled by the old Central.

The Boston Elevated has sold to a syndicate headed by R. L. Day & Company, Estabrook & Co., N. W. Harris & Company and Lee Higginson & Company, $4,000,000, 30-year, five-per-cent gold bonds dated December 1, 1912.

For the first 11 days of December, the Chicago Railways Company showed an increase of $48,825, or 9.58 per cent, in gross receipts over the corresponding period of last year. For November, there was an increase of $125,946, or 9.17 per cent.

Authorization has been granted the Syracuse Lighting Company by the New York Public Service Commission to issue $107,000 of its extension and improvement bonds. These are to be sold at not less than 99, and the proceeds will be used for further gas and electric extensions.

For the construction of an electric traction line between Port Arthur and Beaumont, Texas, the Eastern Texas Electric Company has issued, and Stone & Webster are offering, $800,000 first and collateral-trust, 30-year, five-per-cent bonds, on a 5.40 basis. The Eastern Texas Electric owns the bonds and stock of the companies doing the entire electric lighting and power business in Beaumont, and the entire electric light, power, ice, and refrigerating business in Port Arthur, and also the subsidiary company which will construct the Beaumont-Port Arthur traction line.

The California Railway & Power Company has been incorporated under the laws of Delaware to acquire all the outstanding capital stocks of the United Railroads of San Francisco; San Francisco Electric Railway Company; Sierra & San Francisco Power Company; Coast Valley Gas & Electric Company, and $2,000,000 two-year six-per-cent notes of the United Railroads of San Francisco. The new company is to issue $40,000,000 common stock; $6,874,400 seven-per-cent cumulative preferred and $3,000,000 prior preference, cumulative, seven-per-cent stock, making a total of $49,874,400. The total authorized issue of common stock is $45,000,000; $10,000,000 preferred and $5,000,000 prior preference. The United Railways Investment Company will own all the common and preferred stock.

The joint committee representing the bondholders' and stockholders' committee of the Toledo Railways & Light Company, after a meeting, announced that sufficient stock and bonds had been deposited with the New York Trust Company to warrant declaring the plan of reorganization operative. More than 70 per cent of the $13,000,000 of stock and more than 87 per cent of the five-per-cent collateral-trust bonds have been deposited and much of the stock has paid the $7.50 a share assessment. The committee has decided to extend the time for deposits of stocks and bonds until December 24. Under the plan of reorganization a new corporation, to be known as the Toledo Light & Railways Company, will be incorporated having an issued capitalization of $5,700,000 first-lien notes, $1,200,000 second-lien notes, $6,656,625 six-per-cent preferred stock and $7,966,250 common stock. The new company will be operated by Henry L. Doherty & Company, and will be included in the Utilities Improvement Company recently organized.

Dividends.

American Gas & Electric Company; a regular quarterly dividend of 1.75 per cent on the issue and outstanding common capital stock, payable January 2, 1913, to stockholders of record on the books of the company at the close of business December 17.

Buffalo General Electric Company; a quarterly common dividend of 1.5 per cent, payable December 31, to stock of record December 20.

Canadian Westinghouse Company; the regular quarterly dividend of 1.75 per cent, also bonus of two per cent, both payable January 10 to stock of record December 31.

Capital Traction Company of Washington; a quarterly dividend of 1.5 per cent, payable January 1 to stock of record December 8.

Carolina Power & Light Company; a quarterly preferred dividend of 1.75 per cent, payable January 2 to stock of record December 23.

Cincinnati Street Railway Company; a quarterly dividend of 1.75 per cent, payable January 1 to stock of record December 16.

Detroit Edison Company; a quarterly dividend of 1.75 per cent, payable January 15 to stock of record January 2.

Eastern Michigan Edison Company; a quarterly dividend of one per cent, payable January 15 to stock of record January 2.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 16.	Dec. 9.
American Tel. & Tel. (New York)	139	139
Commonwealth Edison (Chicago)	143	143
Edison Electric Illuminating (Boston)	279	280
Electric Company of America (Philadelphia)	*12½	*12¼
Electric Storage Battery common (Philadelphia)	53¾	54
Electric Storage Battery preferred (Philadelphia)	53¾	54
General Electric (New York)	180¾	184
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅝	1¾
Massachusetts Electric common (Boston)	16¼	16½
Massachusetts Electric preferred (Boston)	72¼	74¼
National Carbon common (Chicago)	120	120
National Carbon preferred (Chicago)	117¼	117½
New England Telephone (Boston)	151	153
Philadelphia Electric (Philadelphia)	23⅜	23⅛
Postal Telegraph and Cables common (New York)	80⅞	84
Postal Telegraph and Cables preferred (New York)	65½	67½
Western Union (New York)	72½	75
Westinghouse common (New York)	76	79½
Westinghouse preferred (New York)	117½	*122

* Last price quoted.

Electric Light & Power Company of Abington and Rockland; a semi-annual dividend of $4 per share, payable January 1 to stock of record December 21.

Kansas Gas & Electric Company; a quarterly preferred dividend of 1.75 per cent, payable January 2 to stock of record December 23.

Lake Shore Electric Railway Company; a quarterly dividend of 1.75 per cent, payable December 31 to stock of record December 22.

Louisville Traction Company; a quarterly dividend of one per cent, payable January 1 to stock of record December 10.

Memphis Street Railway Company; a quarterly preferred dividend of 1.75 per cent, payable December 31 to stock of record December 22.

Nashville Railway & Light Company; a quarterly dividend of 1.25 per cent, payable January 1 to stock of record December 26.

New Orleans Railway & Light Company; a dividend of 0.5 per cent on the common and a quarterly dividend of 1.25 per cent on the preferred stock, both payable December 31.

Philadelphia Company; a regular quarterly dividend of 1.75 per cent on the common stock, payable February 1 to stock of record January 2.

Terre Haute, Indianapolis & Eastern Traction Company; a quarterly preferred dividend of $1.25 per share, payable January 1 to stock of record December 21.

Western Union Telegraph Company; a quarterly dividend of 0.75 per cent, payable January 15 to stock of record December 20.

Reports of Earnings.

INTERBOROUGH RAPID TRANSIT.

	1912	1911
October gross	$2,919,938	$2,707,569
Net after taxes	1,609,015	1,477,992
Other income	35,926	37,067
Total income	1,644,941	1,515,059
Surplus after charges.	726,396	595,946
Passengers carried	57,108,382	52,717,754
Four months' gross	9,962,819	9,314,938
Net after taxes	5,001,900	4,505,702
Other income	125,696	122,857
Total income	5,127,596	4,628,559
Surplus after charges..	1,450,385	1,004,622
Passengers carried	194,048,514	180,743,699

Dividends for the three months ended September 30, 1912 (2.5 per cent) amounted to $875,000.

AMERICAN CITIES COMPANY.

Earnings of the subsidiary corporations of the American Cities Company for the month of October, 1912, and the twelve months ended October 31, 1912, compare as follows:

	1912	1911
October operating revenue	$1,198,620	$1,155,717
October operating income	504,146	463,702
Other income	3,255	2,319
Total income	507,402	466,022
Surplus after charges*.	238,852	210,502
Twelve months' operating revenue	13,706,644	13,097,752
Twelve months' operating income	5,598,780	5,233,863
Other income	32,068	35,469
Total income	5,630,849	5,269,332
Surplus after charges*	2,483,907	2,283,764

*Applicable to dividends and reserves.

Earnings of American Cities Company, from proportion of amounts applicable to dividends and reserve of subsidiary companies for October, 1912, and twelve months ended October 31, 1912, compare as follows:

	1912	1911
October total income..	$216,121	$188,080
Surplus after charges..	174,455	146,414
Twelve months' total income	2,242,247	2,047,866
Surplus after charges..	1,742,247	1,547,866
Preferred dividend	1,233,210	1,233,210
Surplus	*509,037	314,656

* Equal to 3.13 per cent on American Cities common stock, as against 1.93 per cent previous year.

PERSONAL MENTION.

GEORGE H. JONES, power engineer of the Commonwealth Edison Company, Chicago, has left with his family for a month's vacation in California.

W. K. BOARDMAN, superintendent of the Cumberland Telephone & Telegraph Company, has been appointed division commercial superintendent, with headquarters at Nashville, Tenn.

WILLIAM H. HITCHCOCK, of Wilmington, Del., has been appointed to succeed John C. Thompson, who has resigned as general manager of the Trenton & Mercer County Traction Corporation at Trenton, N. J.

THOMAS F. MILEY, formerly master mechanic of the New Jersey & Pennsylvania Traction Company, has been appointed superintendent of the West Chester Street Railway Company, with headquarters at West Chester, Pa.

NELSON B. HAZELTINE has been appointed Philadelphia manager for the Adams-Bagnall Electric Company. He succeeds R. C. Campbell, who has gone to London as representative of the General Motors Truck Company.

SAMUEL G. McMEEN, president of the Columbus Railway & Light Company, on December 13 delivered an address to the students of Ohio State University on "Imagination as an Engineering Asset." This was the first of a series of lectures to the engineering classes.

E. L. CALLAHAN, new-business manager of H. M. Byllesby & Company, Chicago, has returned to Chicago after having attended the convention of the Commercial Gas Association at Atlanta, Ga. Mr. Callahan reports a good attendance and a successful convention.

SHERMAN HARLAN, manager of the New Business Department of the American Gas & Electric Company, East St. Louis, Ill., was married on December 14 to Miss Mabel Merker, of Alexandria, Ind. A large number of friends tendered the happy couple a farewell in the Methodist Church of Alexandria, where the bride had been pipe organist for several years.

FORD HUNTINGTON, former treasurer of the Bell Telephone Company of Pennsylvania, has been elected vice-president of that company and will have charge of the finance and accounting. W. S. Peirsol, former secretary and assistant treasurer, has been made secretary-treasurer of the same and associated companies, and of the Chesapeake & Potomac Telephone Company.

J. C. VAN DUYNE, chief of the Collection Bureau of the New York Edison Company, with which organization he has been associated for an unbroken period of 17 years, has taken the position of auditor of the Edison Electric Illuminating Company of Brooklyn. Mr. Van Duyne joined the New York Edison Company December 2, 1895, as a bookkeeper. He remained in this position for two or three years, when he was made a collector and after serving in that department for some time he was, in June, 1903, put in charge of all collection work. He has always been an enthusiastic member of the Employees' Association, and from 1906 to 1912, was a member of one or more of the various committees or serving in some official capacity. At the St. Louis convention of the National Electric Light Association he presented a paper entitled "Workings of a Collection Bureau."

GEORGE F. CARD, for seven years production manager of the Fort Wayne Electric Works, Fort Wayne, Ind., will leave the company on January 1, 1913, to devote all of his time to the development of the Card machine recorder. This is an instrument for the scientific supervision of power of machine-driven tools. This system was devised by Mr. Card a number of years ago for his personal use and it will now be developed for its general application to machine tools. Mr. Card is placing this apparatus on the market on a very liberal basis and sets forth three very interesting propositions to manufacturers who might undertake to investigate the availability of this device. In his three propositions he outlines as many methods by which a thorough investigation may be made at comparatively little expense to the manufacturer until the entire suitability of the recorder is demonstrated.

S. B. WILLIAMSON, since 1908 division engineer of the Pacific Division of Panama Canal construction, has resigned his position to enter the services of J. G. White & Company, Limited, London and New York. Mr. Williamson was called to the canal service by Colonel Goethals in May, 1907, as division engineer of the Pacific locks and dams. In his later position he had charge of the construction of the locks at Pedro Miguel and Miraflores, involving the placing of vast quantities of concrete, extensive dry excavating and dredging; the construction of the terminal docks at the Pacific entrance; and municipal work in Panama City and the Canal Zone south of Culebra. He was Colonel Goethals's right-hand man. Previous to his work in Panama, Mr. Williamson was engaged in railroad and general construction work in various parts of the United States. He was also in the service of the United States Government for some time and in 1900 was in charge of the fortification work at Newport, R. I. In his new field of work, with J. G. White & Company, he will be associated with its London office in the capacity of principal assistant engineer, directing construction in all parts of the world excepting the United States and its possessions.

DATES AHEAD.

American Association for Advancement of Science and affiliated societies. Annual meeting, Cleveland, O., December 30-January 4, 1913.

Northwestern Cedarmen's Association. Annual meeting, Duluth, Minn., January 7-8, 1913.

South Dakota Independent Telephone Association. Sioux City, S. D., January 8-9, 1913.

American Institute of Consulting Engineers. Annual meeting, Engineers' Club, New York, N. Y., January 14, 1913.

Illinois Electrical Contractors' Association. Annual meeting, Peoria, Ill., January 17-18, 1913.

Peoria Electrical Show. Peoria, Ill., January 18-25, 1913.

Ohio Engineers' Society. Columbus, O., January 21, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

With the Electrical Manufacturers

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has removed its offices and factory to its new and spacious building at the corner of Connecticut and Florence Avenues.

National X-Ray Reflector Company, Chicago, Ill., has issued a well-illustrated booklet that points out the advantages of its mirrored-glass reflectors when applied to commercial and industrial lighting. Over a dozen typical installations are shown in which the high and enduring efficiency of the reflectors has been proven.

The Electrose Manufacturing Company, Brooklyn, N. Y., announces that First Assistant Commissioner Billings of the United States Patent Office, in the appeal by Steinberger from the decision of the Examiners-in-Chief, affirming the decision of the Examiner of Interferences, awarding priority of invention to Hewlett as to the disk strain insulator in the Steinberger application serial No. 411,812, patent No. 904,370, reversed the decision of the Examiners-in-Chief. It is held that the invention of the issue was first disclosed by Steinberger.

Joseph Dixon Crucible Company, Jersey City, N. J., manufacturer of graphite and graphite products, announces that the selling price of its silica-graphite paint has been reduced; this has been made possible by the decreased cost of linseed oil and is in line with the company's policy to give its customers any possible benefit from decreased cost of materials or manufacture. This well-known paint has been the standard for nearly 50 years with leading railroads and manufacturing plants as a maintenance paint and long-service protector of all exposed steel and other metal surfaces.

The Electric Storage Battery Company, Philadelphia, Pa., has just issued an "Instruction Book for the Operation of Exide Vehicle Batteries," a small book of only six pages which gives in remarkably few words all the necessary information which the owner of an electric vehicle need possess to keep his battery in good working order. It is an indication of the simplicity and ease of operation of the electric vehicle when equipped with a dependable battery. Those who have hitherto imagined the vehicle battery to be a complicated and troublesome piece of apparatus to maintain should send for a copy of this booklet, which covers the instruction for the Ironclad-Exide, Exide, Hycap-Exide, and Thin-Exide batteries.

Woodmansee, Davidson & Sessions, consulting engineers, First National Bank Building, Chicago, Ill., announce that they have associated with them in the capacity of combustion engineer, C. M. Garland, late of R. D. Wood Company, and formerly of the faculty of the University of Illinois. Mr. Garland has had an extensive experience in theoretical and practical combustion work during the past ten years, and has specialized in the gasification of fuels and the application of producer water gas to industrial and power requirements. After January 1, 1913, Woodmansee, Davidson & Sessions, in addition to their present line of work, will be open for consultation on the design and operation of producer and water-gas apparatus, gas power installations, gasification of low-grade fuels and the application of gas to various heating problems.

Crocker-Wheeler Company, Ampere, N. J., has just established a new record of rapid completion of a concrete building. This accommodates a new punch-press department and is 80 by 80 feet in area and 15 feet high with a monitor roof and five-ton crane. The necessity for increased facilities for this department was very urgent. One day after the construction of the building was determined on, the contract was let. Nine days later the sheet-steel material to be punched was being unloaded. Twelve days later the heavy punch presses, weighing up to 19 tons, were being placed on the fresh concrete floor. Exactly one month from the inception of the building, 20 carloads of sheet steel were being punched by the 10 big punch presses, a full equipment of dies and grinders was installed and the entire new shop was working at maximum capacity as an integral and permanent unit of the big Crocker-Wheeler plant.

The Hess-Bright Manufacturing Company, Philadelphia, Pa., announces that the stock holdings formerly owned by Henry Hess in the company have been purchased outright by the Deutsche Waffen und Munitionsfabriken, of Berlin, Germany, the controlling ownership remaining in America in the hands of F. E. Bright, president of the company. Mr. Hess retires to devote himself to his various other interests. The company is making extremely large additions and improvements to its German works, which already is probably the most extensive in existence. It is also making desirable improvements in the facilities for American distribution of a constantly increasing output, and wishes to assure its patrons of its full realization of the importance of unfaltering ambition at all times toward betterment and that no expenditure of effort or money is being spared to effect advancement in all branches of its business.

Record of Electrical Patents.

Issued by the United States Patent Office, December 10, 1912.

1,046,431. Electric Lamp Socket. R. B. Benjamin, assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. The casing has a supporting bushing at one end, a shade-holder at the other and a movable cover for an opening in the side.

1,046,463. Electric Circuit-Controller. W. D. Heath, assignor to A. V. Manufacturing Co., New York, N. Y. An ignition-circuit-distributer with a rotating cam and right-angled contact-making rocker arms.

1,046,464. Method of Making Homogeneous Mechanical Junctures. A. B. Herrick, assigner to Electric Railway Improvement Co., Cleveland, O. Rail bonds are electrically welded to the rail heads by means of a lateral electrode.

1,046,465. Electric Shunt Connection. A. H. Hoyt, Penacook, N. H. Special bolts are provided at the ends of an instrument shunt.

1,046,471. Automatic Electric Piano-Player. L. J. Le Pontois, New Rochelle, N. Y. The action includes electromagnets co-operating with rotating disks to operate the hammers.

1,046,473. System of Control. C. E. Lord, Milwaukee, Wis. An automatic time-limit control system for railway motors in which the switches are governed by solenoids and compressible resistances.

1,046,499. Automatic Controlling Switch for Electric Circuits. G. J. Schneider, Detroit, Mich. Overheating of a register in the circuit causes a thermostatic switch to operate.

1,046,500. Driving of Single-Phase Motors. K. Schnetzler, assignor to Actiengesellschaft Brown, Boveri & Cie., Baden, Switzerland. Two motors have their stators connected to three-phase mains by a modified Scott connection.

1,046,514. Electrically Heated Hosiery Form. F. M. Vogel, assignor to General Electric Co. Is composed of two metal plates with heating element between them and with interchangeable toe portions.

1,046,543. Thermostat. D. Beatty, Berkeley, Cal. A float in a mercury column indirectly controls electric circuits.

1,046,544. Game Board. W. F. Beatty, Laurel Hill, N. Y. The board has a representation of a baseball field with electric lamps for players; switches and a commutator control the lamps.

1,046,547. Incandescent Electric Lamp. F. Benz, Jr., assignor to J. Frank, New York, N. Y. Provides special connec-

tions from a tungsten filament to the leading-in wires.

1,046,554. Telephone Receiver. C. L. Chisholm, Maryville, N. B., Can., assignor to Chisholm Transmitter & Telephone Instruments Co. Has a stiff ring united to the periphery of the diaphragm.

1,046,573. Electric-Light Bracket. F. L. Ellis, Milldale, Conn., assignor to Wm. F. Wolff Co. Has pivotally jointed sections secured to a base and stem.

1,046,579. Magneto Drive for Internal-Combustion Engines. W. H. Frost, assignor to General Electric Co. Several magnetos, one for each pair of radial cylinders, are driven through a common actuating gear.

1,046,588. Refrigerating Apparatus. C. H. Hapgood, Boston, Mass. Includes an electric motor for driving the pump, an electromagnetic valve and a thermostatic circuit-controller.

1,046,597. Signal Device for Railways. J. Jennings and W. H. Jennings, Greenwood, Ind. The signal-circuit switches are controlled by the passage of the trolley wheels.

1,046,601. Polyphase-Motor Cascade Driving System. C. de Kando, Budapest, Austria-Hungary. One of each pair of induction motors has a stator arranged for cascade connection or for connection direct to the line.

1,046,514.—Electric Hosiery Drier.

1,046,605. Electric Railway-Gate. C. F. Kettering, assignor to C. E. Mendenhall and L. P. Earnshaw, Dayton, O. A motor-operated gate.

1,046,608. Operating Means for Doors. G. J. Kosters, Covington, Ky. An electromagnetically controlled coupling for the motor-operated bar.

1,046,609. Safety Device for Elevators. S. Kosztura, Gary, W. Va. Electrically operated valve for a pneumatic cylinder.

1,046,614. Ignition System. E. S. Lincoln, Brookline, Mass. Includes a generator, induction coil, electromagnetically controlled circuit-breaker and condenser.

1,046,626. Automatic Signal. R. M. Millar, Chicago, Ill. A thermostatic circuit-breaker is connected with an alarm circuit.

1,046,630. Alarm Aattachment for Incubators. J. C. Munson, Pontiac, Ill. An electric alarm associated with a thermostat.

1,046,634. Electric Signal Device. H. A. Parrish, Kalamazoo, Mich. An automatic signal switch controlled by the movements of the trolley wheels.

1,046,639. Electric Welding Machine. R. C. Pierce, assignor to Toledo Electric Welder Co., Cincinnati, O. Includes a special die-carrying head adapted for swivel movement.

1,046,677. Reflecting Electrical Lamp. E. H. Tate, Los Angeles, Cal. Has a concave reflector within the neck of the bulb and an annular reflector outside of it.

1,046,680. Graphic Recorder. C. B. Thwing, assignor to Thwing Instrument Co., Philadelphia, Pa. An automatic multiple recorder including a galvanometer, chart-moving mechanism and means for periodically touching the pen to the chart.

1,046,685. Magnetic Separator. G. Ullrich, Broken Hill, N. S. W., Australia. Has radial magnets and concentric magnetic separator rings.

1,046,688. Motor-Starting Controller. T. Varney and G. Tarkington, assignors to Westinghouse Electric & Manufacturing Co. As each switch is manually closed in sequence the preceding switch is automatically opened.

1,046,689. Telephone Holder. R. M. Vick, Canton, O. A bracket carries a shelf and fingers to hold the base of a desk set.

1,046,703. Railway Signaling System. A. J. Wurts, assignor to Union Switch & Signal Co., Swissvale, Pa. An electric block-signal system.

1,046,705. Electrical Fuse-Holder. H. W. Young, Chicago, Ill. The cartridge case is longitudinally divided into two parts.

1,046,708. Portable Rheostat for Welding Apparatus. J. M. Yount, assignor of one-third each to E. S. Brannaman and T. Finigan, San Francisco, Cal. The resistance elements are mounted on a wagon with ventilating covers.

1,046,714. Telegraphy. M. O. Anthony, assignor of one-half each to C. H. Walker and D. I. Garretson, New York, N. Y. Makes use of a rapidly pulsating current.

1,046,722. Support for Incandescent-Lamp Filaments. G. W. Beadle, assignor to Westinghouse Lamp Co. A Y-shaped support in the center of a tubular lamp.

1,046,723. Tube-Cutting Machine. G. W. Beadle, assignor to Westinghouse Lamp Co. For use in making tubular lamps.

1,046,724. Machine for Manufacturing Supports for Incandescent-Lamp Filaments. G. W. Beadle, assignor to Westinghouse Lamp Co. Has reciprocating forming and cutting jaws.

1,046,743. Means for Insulating Electrical Machines. W. A. Dick, assignor to Westinghouse Electric & Manufacturing Co. Insulating fabric is held by a clamping ring around and beyond the outer edge of the commutator.

1,046,748. Electric Vehicle Motor and Means for Suspending the Same. G. M. Eaton, assignor to Westinghouse Electric & Manufacturing Co. The motors for a locomotive are mounted above the plane of the axles and connected to the drive wheels by cranks and connecting rods.

1,046,750. Electric Meter. J. B. Entz, assignor to General Electric Co. A motor-driven switchboard meter with magnetic and dynamometer control for the retarding brake.

1,046,759. Connecting Device for Electric Conductors. D. T. Fisher, Columbus, O., assignor to Jeffrey Manufacturing Co. A plug connector in a flame-proof casing.

1,046,765. Electric Signaling System. C. F. Frank, New York, N. Y. Includes a number of switches, each with an electromagnetically controlled circuit-closer.

1,046,777. Electric Heating Apparatus. W. S. Hadaway, Jr., assignor to Westinghouse Electric & Manufacturing Co. A flatiron with thermostatically controlled switch.

1,046,780. Connection between Metallic Filaments and Feed Wires of Electric Incandescent Lamps. F. Hanaman, assignor to General Electric Co. The joint is made with a metallic phosphide.

1,046,782. Electric-Dispatch System. K. Hansel, Vienna, Austria-Hungary. The starting and speed of the motor cars is controlled from the sending station; there is also a signal system.

1,046,785. Electric Incandescent Lamp. R. H. Henderson, assignor to Westinghouse Lamp Co. Mounting for a V-shaped filament.

1,046,793. Stop Motion. J. L. Jackson, Glastonbury, Conn. Electric means for stopping a loom when a warp thread breaks.

1,046,794. Railway Signal Device. J. Jennings and W. H. Jennings, Greenwood, Ind. Movements of the trains control circuit-breakers in the signal circuit.

1,046,796. Electric Switch. J. D. Johnson, Boston, Mass. Construction details of a rotary snap switch.

1,046,816. Electric Resistance Unit. E. N. Lightfoot, New York, N. Y. Triangular convolutions of the resistance ribbon are mounted about a supporting rod.

1,046,822. Tension Device. H. D. Madden, assignor to Westinghouse Lamp Co. A drawn-wire filament is kept under tension while moving by means of a draft device.

1,046,677.—Reflecting Lamp.

1,046,823. Electrical Switch-Contact. F. R. McBerty, assignor to Western Electric Co., Chicago, Ill. Is composed of platinum foil on which a copper backing is electrodeposited.

1,046,824. Method of Making Bimetallic Plates. F. R. McBerty, assignor to Western Electric Co. The copper for the preceding is deposited by a feeble current at first and this is gradually strengthened.

1,046,834. Core Structure for Dynamo-Electric Machines. C. B. Mills, assignor to Westinghouse Electric & Manufacturing Co. The laminae are mounted with a close fit on a knurled part of the shaft.

1,046,846. Circuit-Controller. D. L. Ordway and J. W. Brown, assignors to National Carbon Co., Cleveland, O. A distributer for ignition circuits.

1,046,954. Electric Switch. R. L. Ramsay, assignor to J. H. Bunnell & Co., New York, N. Y. A series of normally closed spring terminals for line circuits is arranged in the arc of a circle; a pivoted branch-circuit switch can be connected into any line clips.

1,046,859. Electrically Heated Receptacle. J. M. Roe, Sunnyside, Wash., assignor of one-half to C. Newcomb. A vessel rests on a heating element and rotation thereof closes the circuit.

1,046,860. Electrical Circuit Protector. C. A. Rolfe, assignor to Rolfe Electric Co., Rochester, N. Y. A heat-responsive device includes a mass of solder.

1,046,868. Strain Insulator. E. E. Schmid, assignor to Shield Electric Co., New York, N. Y. Has saddles at right angles to receive interlocking strands.

1,046,883. Electric Measuring Instrument. H. C. Specht, assignor to Westinghouse Electric & Manufacturing Co. Provides low-resistance shunts and neutralizing means for the indicating coil.

1,046,887. Electric Heating Device. W. Stanley, assignor to General Electric Co. The heating element is cast in so as to be nearer to the lower surface at the tip of the flatiron.

1,046,888. Electric Heater. W. Stanley, assigner to General Electric Co. A fluid receptacle with flat resistance strip cast into and parallel with the walls near the bottom.

1,046,899. Push Switch. G. B. Thomas and E. Anderson, assignors to Perkins Electric Switch Manufacturing Co., Bridgeport, Conn. Relates to details of the mechanism.

1,046,918. Electric Incandescent Lamp with Bipartite Bulb. P. Weisse, Hanover, and S. Bloch, Charlottenburg, Germany. Has an inner and an outer cap, the latter and the bulb being connected in seats of the inner cap.

1,046,925. Pyrometer. J. E. Wilson, New York, N. Y. A thermo-electric couple connected to a galvanometer.

1,946,928. Commutator. C. Zenk, Wilkinsburg, Pa., assignor of one-fifth to W. M. Ebberts. The segments and mica strips between them are mounted in an insulating body.

1,046,934. Transformation of Direct Currents. P. Amsler, assignor to Aktiengesellschaft Brown Boveri & Cie., Baden, Switzerland. A low-tension shunt dynamo is driven by a high-tension motor with three field coils, one in series with the motor, one in series with the dynamo and one in shunt to the dynamo.

1,046,952. Automatic Telephone System. E. Blos, Schöneberg, near Berlin, Germany. Relates to the interconnection of the preliminary and first selectors.

1,046,953. Speed-Responsive Switch. P. J. Bodine and C. D. Bodine, Chicago, Ill. A centrifugally operated motor switch with an air blast to extinguish the arc.

1,046,968. Incandescent-Lamp Socket. L. J. Castonguay, assignor to Perkins Electric Switch Manufacturing Co., Bridgeport, Conn. Relates to the key switch.

1,046,972. Electric-Light Fixture. W. J. Cherry, New York, N. Y. A hickey for bracket fixtures.

1,046,982. Sound Producing and Amplfying Apparatus. F. J. B. Cordeiro, Newton Center, Mass. Includes an electromagnet in circuit with the transmitter and battery, a diaphragm and sounding board.

1,046,984. Spreader for Telephone-Receiver Casings. P. M. Cox, Meridian, Tex. A threaded conical expanding screw that fits into a divided mandrel.

1,046,985. Electrical Device. J. Creedon, North Philadelphia, Pa. A contact button fitted into a glove.

1,047,004. Electric Heating Device. J. O. Dimmick, assignor to Electric Heat Conserving Co., Los Angeles, Cal. The heating element is in the base, above it is a heat retainer and the outer shell is a water vessel with faucet.

1,047,045. Electric Lighting Device for Motor-Vehicle Lamps. H. D. Grinnell, New York, N. Y. An electric sparker for lighting an acetylene lamp may temporarily be connected in place of one of engine sparkers.

1,047,059. Insulator Support for Line Wires. H. L. Hoybook, Tyler, Tex. An angle-iron bracket has secured to it a clamping shoe to hold the base of the insulator.

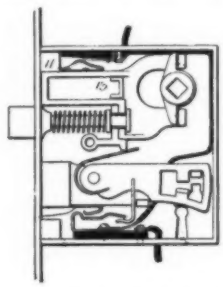
1,047,060. Electrically Generated Steam Vulcanizer. A. C. Hulbert, Santa Rosa, Cal. A predetermined pressure of steam opens the heating circuit.

1,047,069. Signaling Machine. A. C. Kail, U. S. Navy. Has tubular incandescent lamps at each end of centrally pivoted arms.

1,047,074. Electric-Light Fixture. R. S. Kennedy, assignor to W. J. Cherry, New York, N. Y. A special form of hickey for bracket fixtures.

1,047,080. Warp Stop-Motion for Looms. G. Koch, assignor to S. Blumenthal & Co., New York, N. Y. Breaking of a warp thread closes a circuit that acts on the control lever.

1,047,084. Corner Iron for Panel Boards. H. Krantz, New York, N. Y. Metal plates with lugs and a clamping member reinforce the corners.



1,047,105.—Lock Alarm.

1,047,085. Metering Panel. H. F. Krantz, New York, N. Y. A selective contact device may be locked with any one of the meter bars and any branch circuit.

1,047,086. Panel Board. H. F. Krantz, New York, N. Y. The busbars are in different planes above the rear plate and the branch-circuit switches have knife blades to directly engage two of the bars.

1,047,087. Lighting Fixture. A. H. Krom, Chicago, Ill. A semi-indirect fixture with an open prismatic reflector about and beneath the lamp, a dust-proof translucent diffusing bowl and reflecting cover beyond the reflector.

1,047,088. Electric Cooking Utensil. F. Kuhn, Detroit, Mich. A flanged hot plate like a frying pan.

1,047,105. Alarm Lock. L. Nagy, New York, N. Y. Turning of the bolts closes an alarm circuit.

1,047,110. Street-Car Signal. A. O. Nichols, Omaha, Nebr. Electric signals at the rear of cars running in opposite directions on parallel tracks are actuated when the cars approach.

1,047,112. Electric-Circuit Controller. O. P. Noisom and H. Koontz, South Bend, Ind. Dropping of a coin closes an electric fan-motor circuit for a certain length of time.

1,047,114. System of Starting Internal-Combustion-Engine-Driven Motor Vehicles. H. G. O'Neill, Detroit, Mich., assignor of one-fourth each to W. E. Thompson and J. F. O'Brien. A storage battery of limited capacity is temporarily connected to a motor that turns over the engine.

1,047,120. Sanitary Device for Telephone Mouthpieces. G. S. Bennett, San Francisco, Cal. A sheet of paper is carried across the mouthpiece between two rollers.

1,047,121. Sanitary Guard for Telephones. G. S. Bennett, San Francisco, Cal. An amplification of the above.

Patents that Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 17, 1912.

551,355. Mop Wringer. W. G. Archer, Burlington, Vt.

551,364. Magnetic Electric-Lamp Holder. M. H. Collom, Denver, Col.

551,371. Means for Operating and Regulating Speed of Electric Motors. R. Eickemeyer, Yonkers, N. Y.

551,372. Electric Program Clock. F. Frick, Waynesborough, Pa.

551,388. Strong-Current Protector. A. L. Joynes, Paducah, Ky.

551,391. Automatic Telephone-Exchange System. W. F. Lounsbury, Owego, N. Y.

551,394. Electric Light. D. Misell, New York, N. Y.

551,436. Electric Meter. T. Duncan, Fort Wayne, Ind.

551,451. Electric Lighter. H. F. Rider and J. Hencken, New York, N. Y.

551,470. Controlling Electric Motors. D. Mason, Schenectady, N. Y.

551,515. Teletyper. C. Spiro, New York, N. Y.

551,534. Closed-Conduit Electric Railway System. F. C. Esmond, Brooklyn, N. Y.

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551,537. Closed-Conduit System for Electric Railways. F. C. Esmond.

551,551. Holder for Telephone Receivers. F. W. Martland, Fall River, Mass.

551,567. Electric Motor. M. J. Wightman and O. C. G. Urban, Cleveland, Ohio.

551,613. Hoisting and Traveling Cable-Crane. W. F. Brothers, Brooklyn, N. Y.

551,614. Cable-Crane with Gravity Anchor. W. F. Brothers.

551,633. Electric Motor. F. E. Herdman. Winnetka, Ill.

551,634. Mechanism for Admission and Regulation of Currents to Motors. F. E. Herdman.

551,635. Mechanism for Admission of Currents to Motors and Regulation of Currents in Same. F. E. Herdman.

551,664. Electric Railway Motor Shield. I. F. Baker and W. R. McLain, Lynn, Mass.

551,674. Telephone Transmitter. T. Grissinger, Mechanicsburg, Pa.

551,682. Electric Lock. P. Meyer and J. A. Meyer, Newark, N. J.

551,712. Dynamo-Electric Machine. A. B. Blackburn and W. Buchanan, Wolverhampton, England.

551,734. Transmission of Electricity to Moving Cars. T. Nelson, Indianapolis, Ind.

551,743. System for Regulating Effective Tension of Electrical Circuits. H. O. W. J. Breul, Berlin, Germany.